1.0.0250.1+3888650

FIG. 1

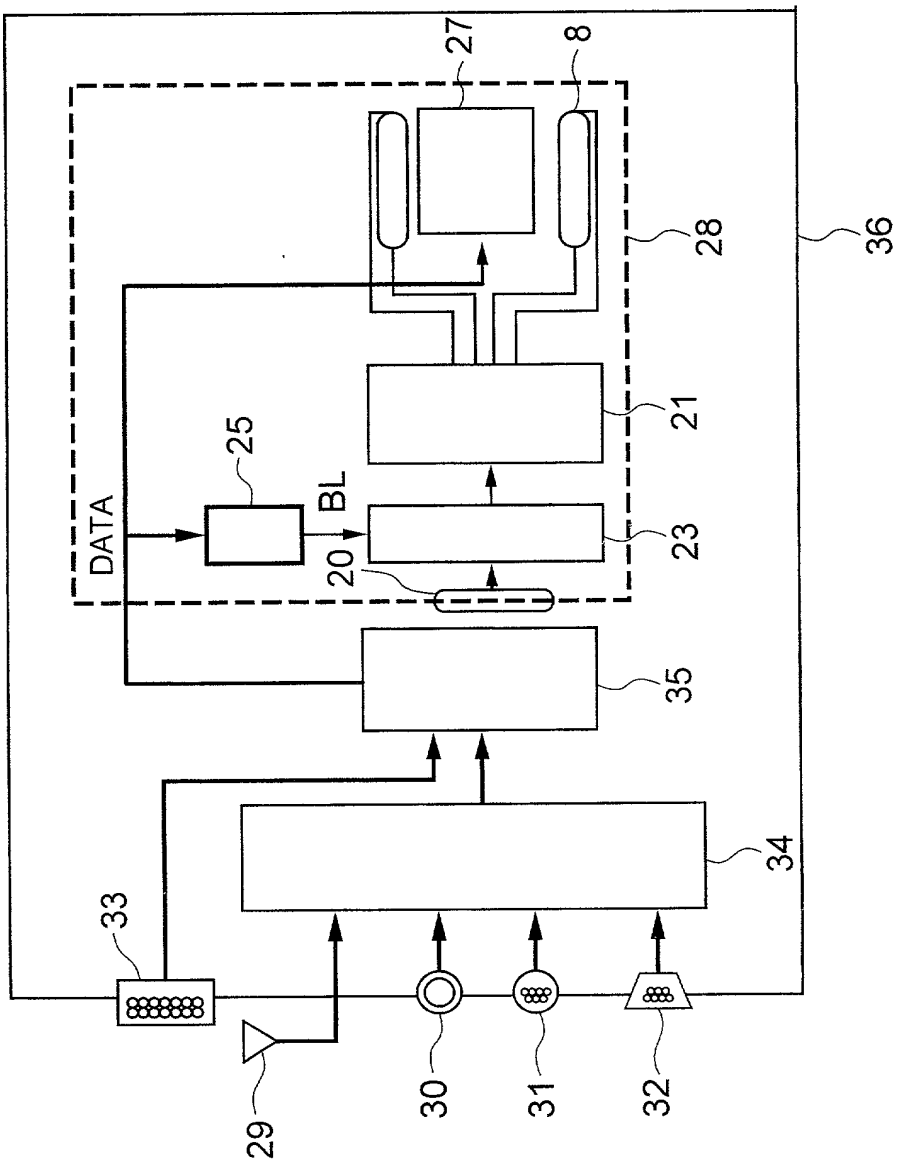


FIG. 2

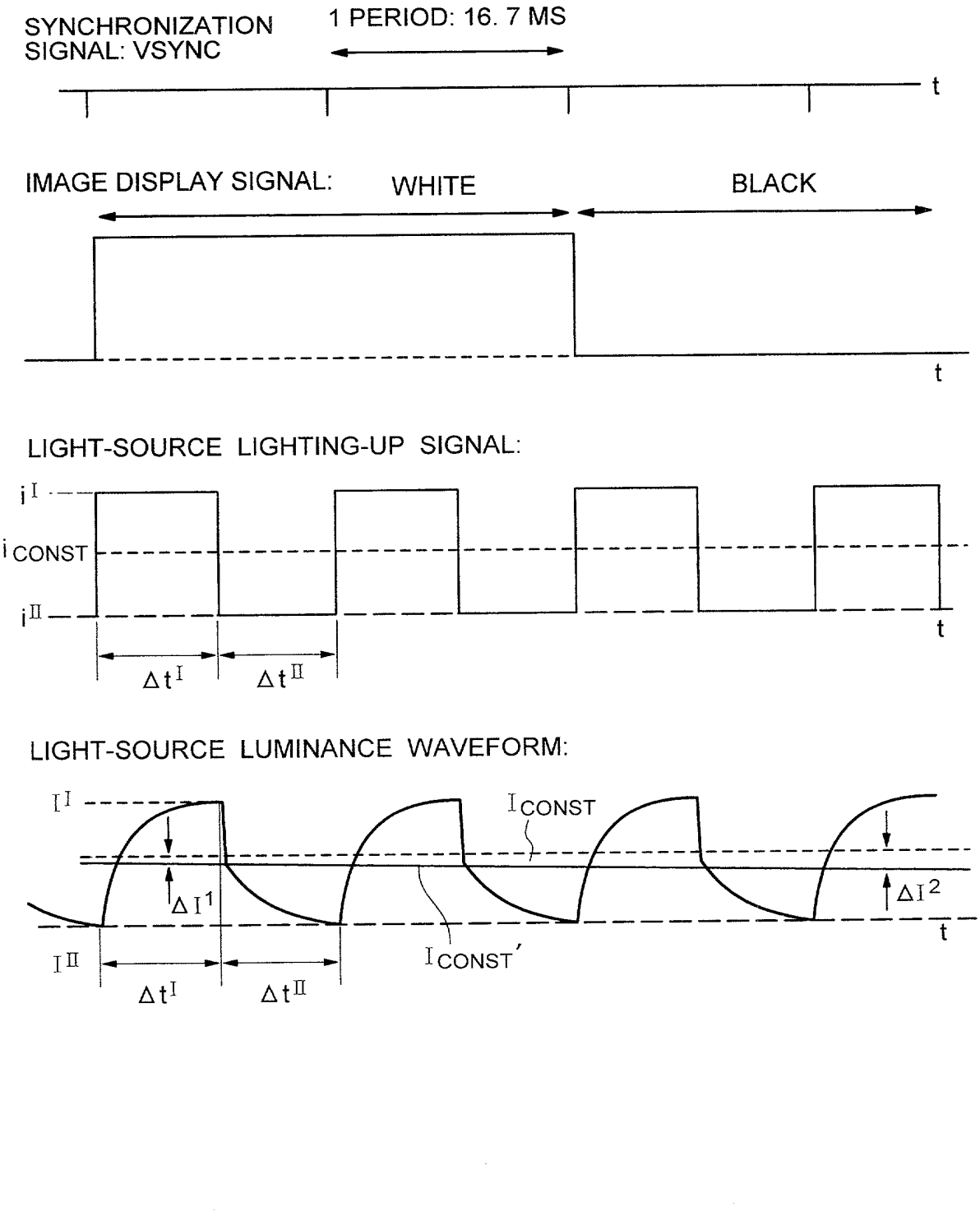

SYNCHRONIZATION SIGNAL: VSYNC
1 PERIOD: 16. 7 MS
t
IMAGE DISPLAY SIGNAL:
WHITE
BLACK
t
LIGHT-SOURCE LIGHTING-UP SIGNAL:
i^{I}
i_{CONST}
i^{II}
t
Δt^{I}
Δt^{II}
LIGHT-SOURCE LUMINANCE WAVEFORM:
I^{I}
I_{CONST}
ΔI^{1}
ΔI^{2}
t
I^{II}
I_{CONST}'
Δt^{I}
Δt^{II}

FIG. 3A

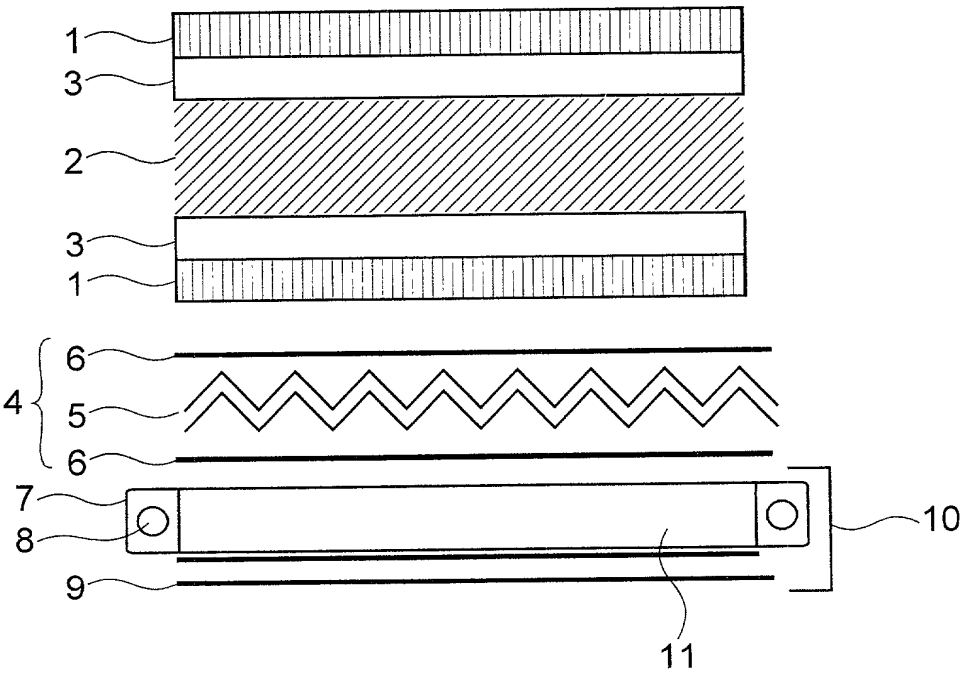


FIG. 3B

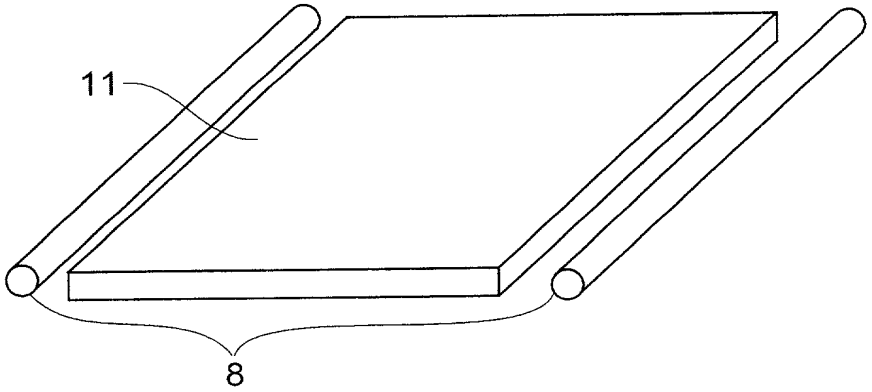


FIG.4A

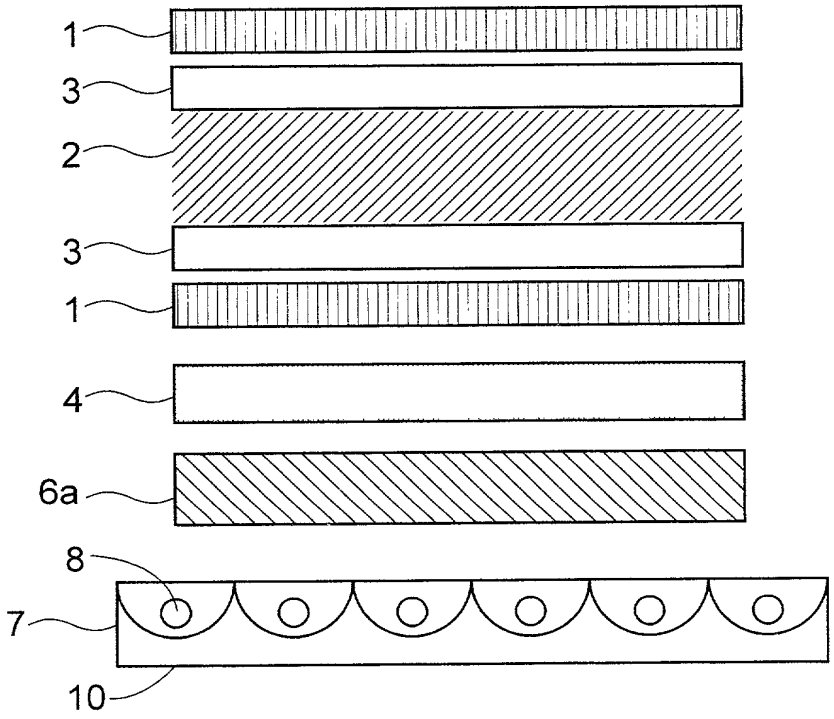


FIG.4B

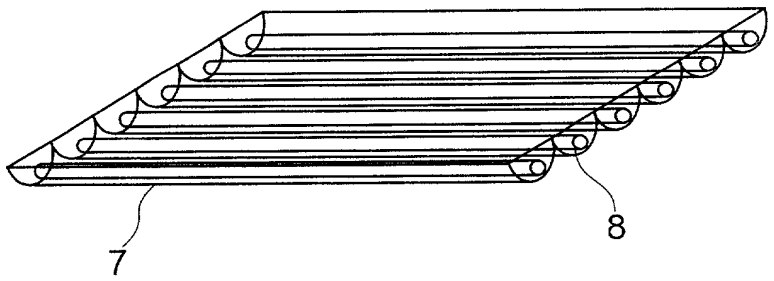


FIG.5A

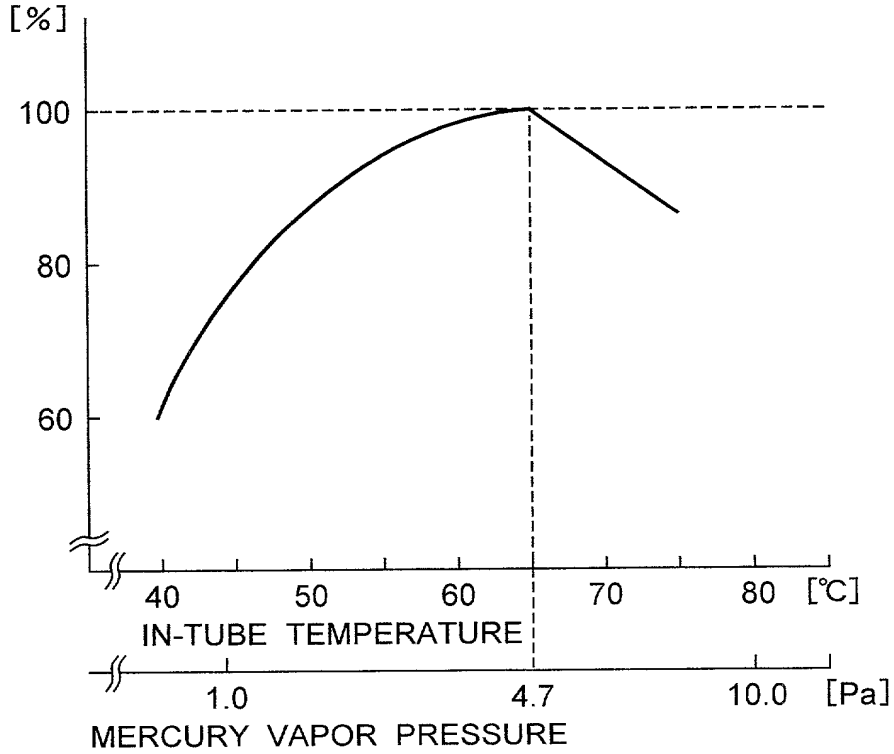
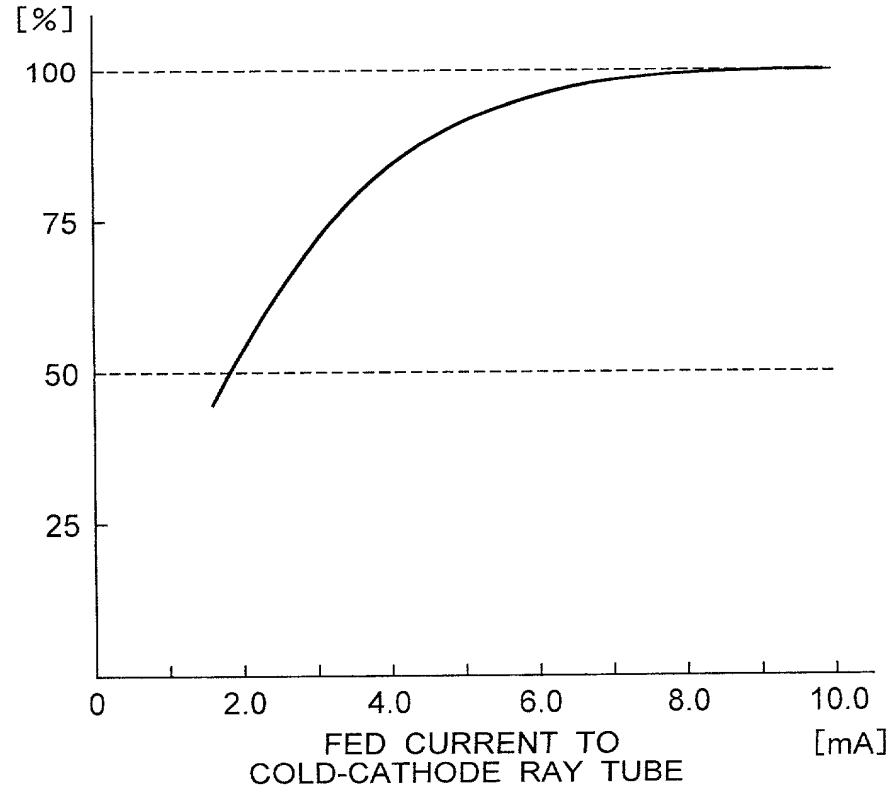


FIG.5B



JP 2005-174950 A 2005.06.30

FIG. 6

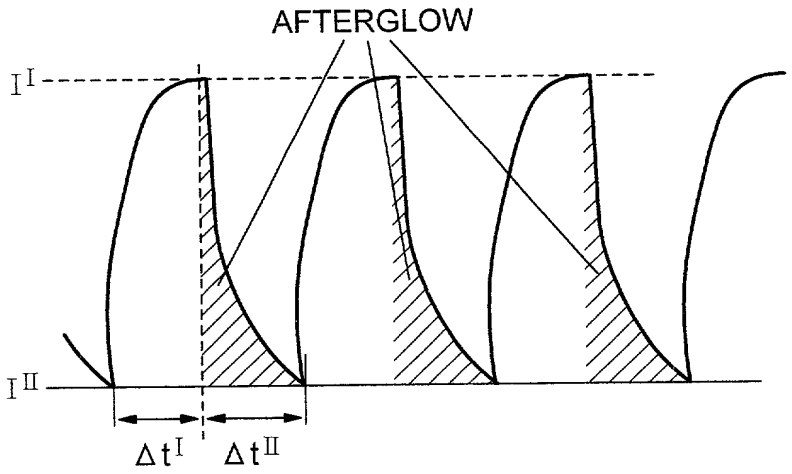


FIG. 7A

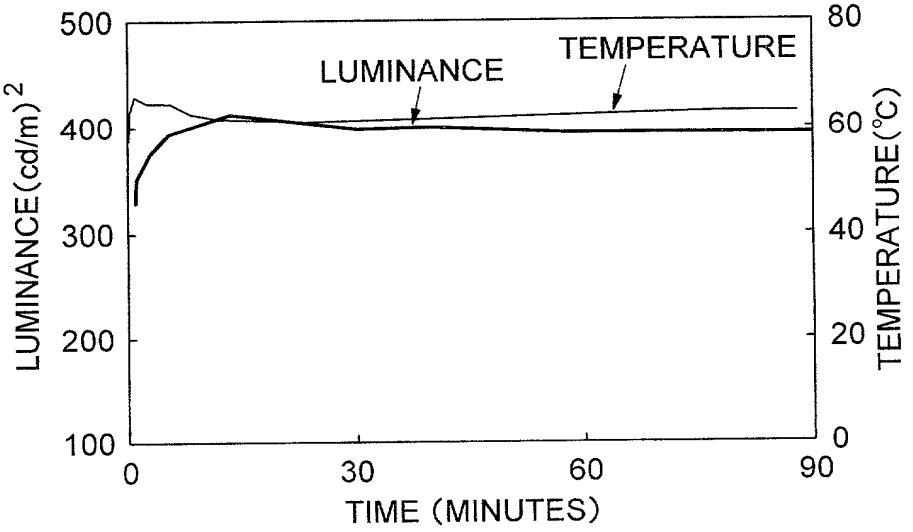


FIG. 7B

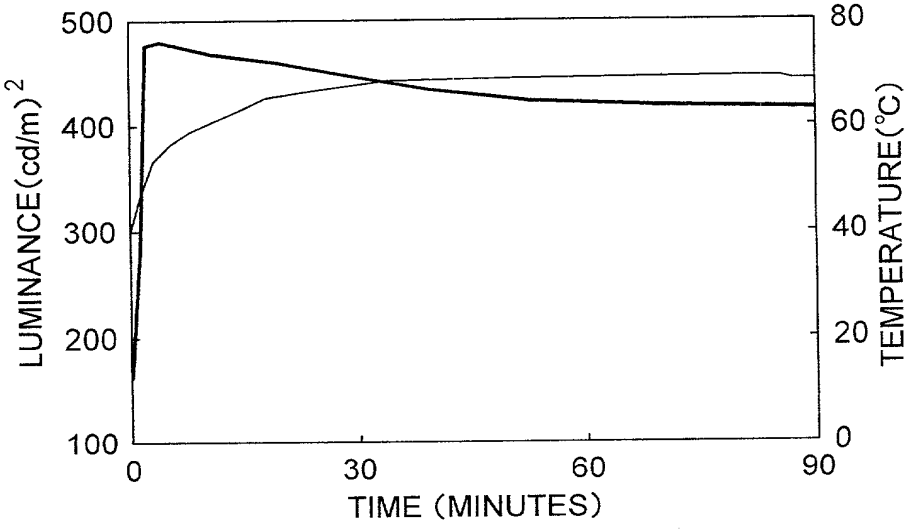


Fig. 7a, 7b, 8a, 8b

FIG. 8

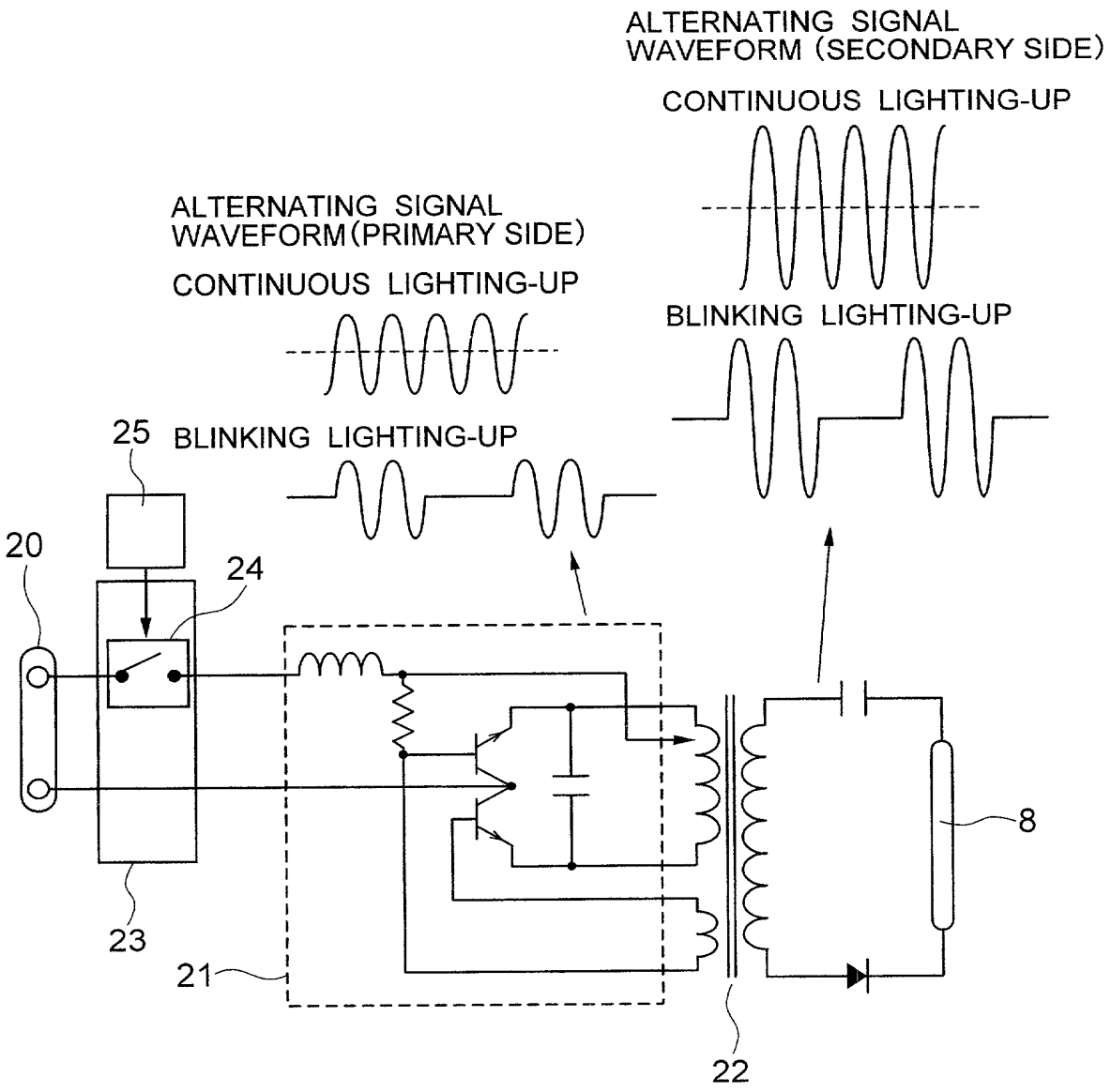

ALTERNATING SIGNAL
WAVEFORM (SECONDARY SIDE)
CONTINUOUS LIGHTING-UP
BLINKING LIGHTING-UP
ALTERNATING SIGNAL
WAVEFORM (PRIMARY SIDE)
CONTINUOUS LIGHTING-UP
BLINKING LIGHTING-UP
25
20
24
23
21
22
8

FIG. 9

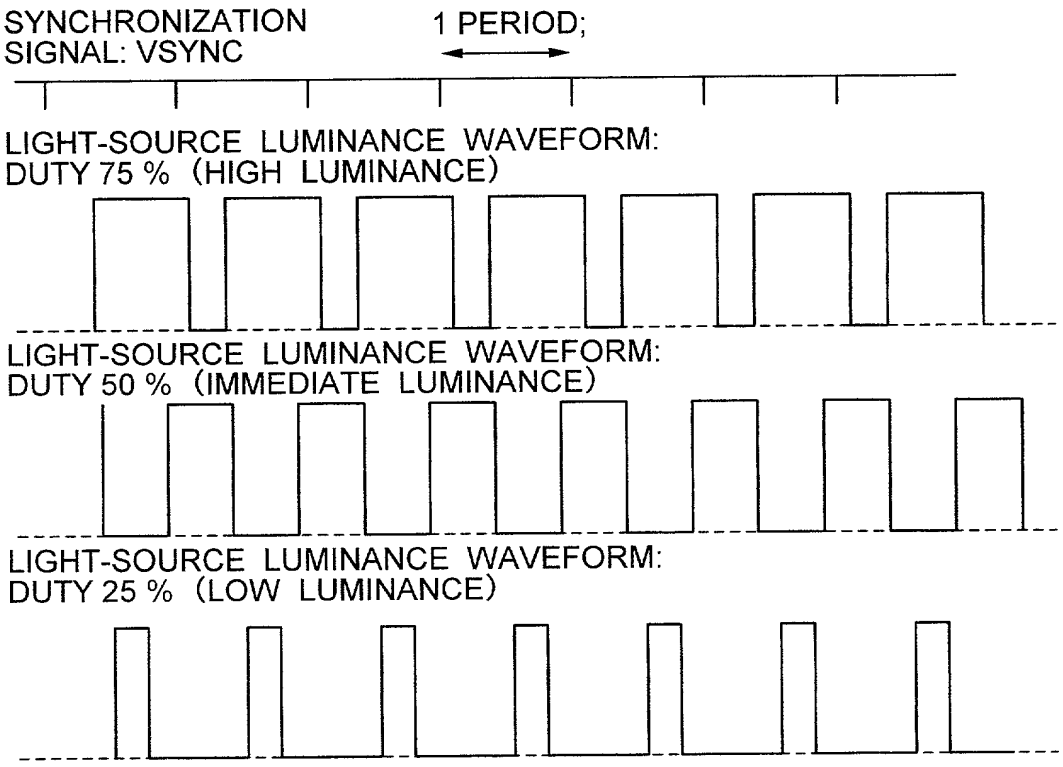

SYNCHRONIZATION SIGNAL: VSYNC
1 PERIOD;
LIGHT-SOURCE LUMINANCE WAVEFORM: DUTY 75 % (HIGH LUMINANCE)
LIGHT-SOURCE LUMINANCE WAVEFORM: DUTY 50 % (IMMEDIATE LUMINANCE)
LIGHT-SOURCE LUMINANCE WAVEFORM: DUTY 25 % (LOW LUMINANCE)

FIG. 10

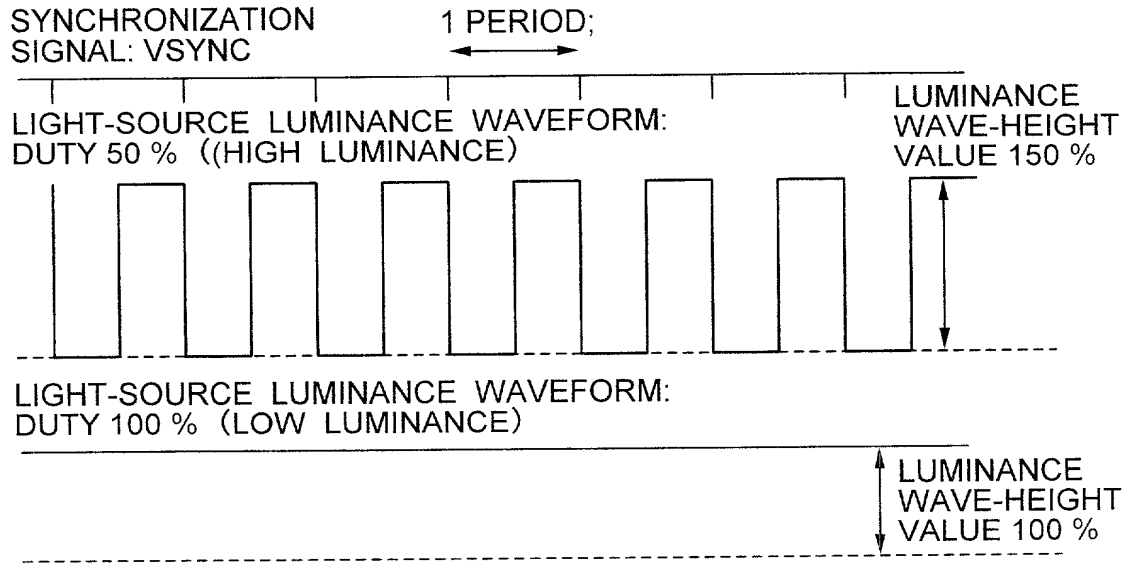

SYNCHRONIZATION SIGNAL: VSYNC
1 PERIOD;
LIGHT-SOURCE LUMINANCE WAVEFORM: DUTY 50 % ((HIGH LUMINANCE)
LUMINANCE WAVE-HEIGHT VALUE 150 %
LIGHT-SOURCE LUMINANCE WAVEFORM: DUTY 100 % (LOW LUMINANCE)
LUMINANCE WAVE-HEIGHT VALUE 100 %

FIG. 11A

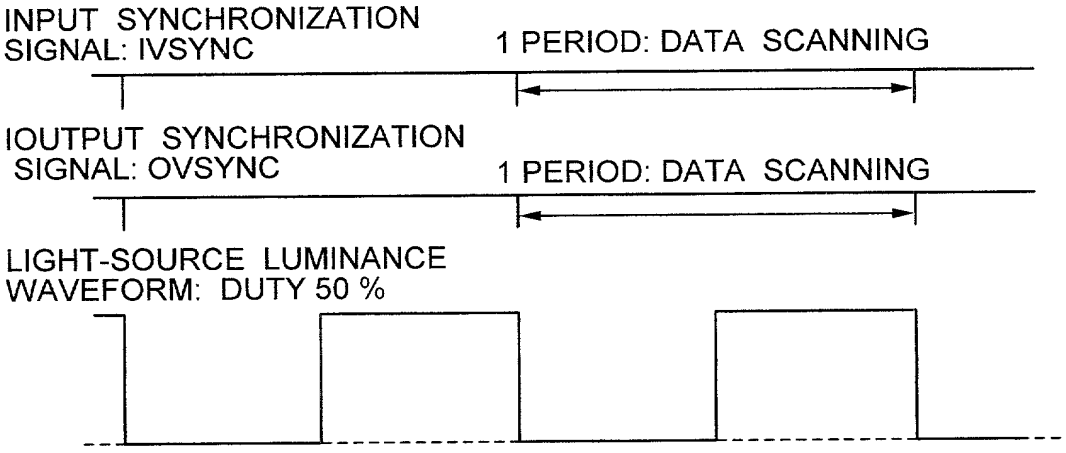


FIG. 11B

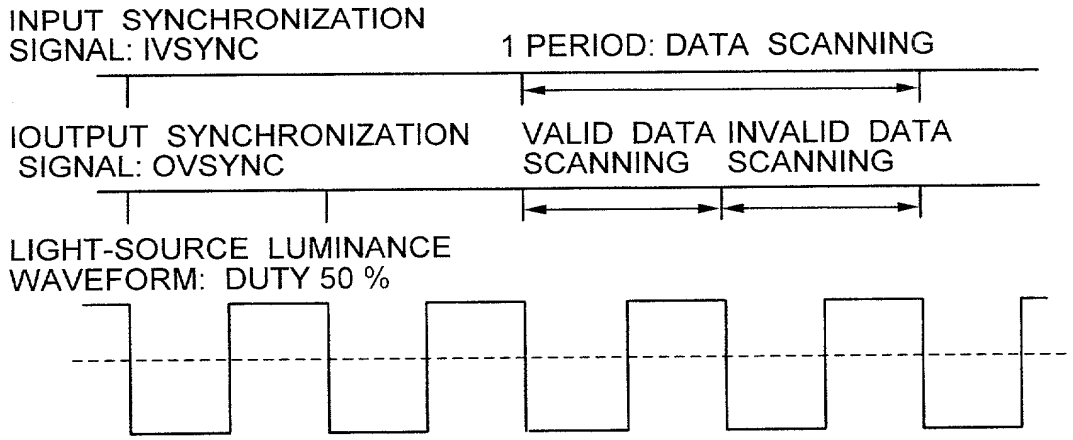
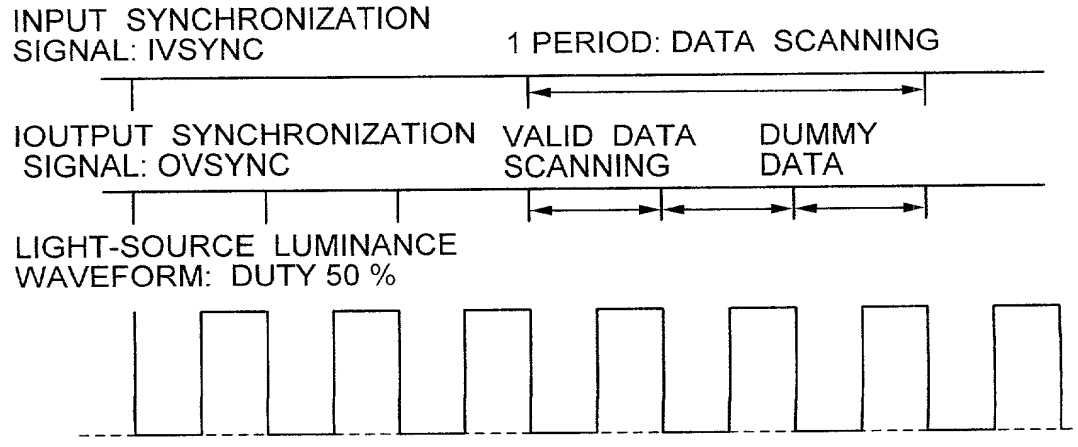
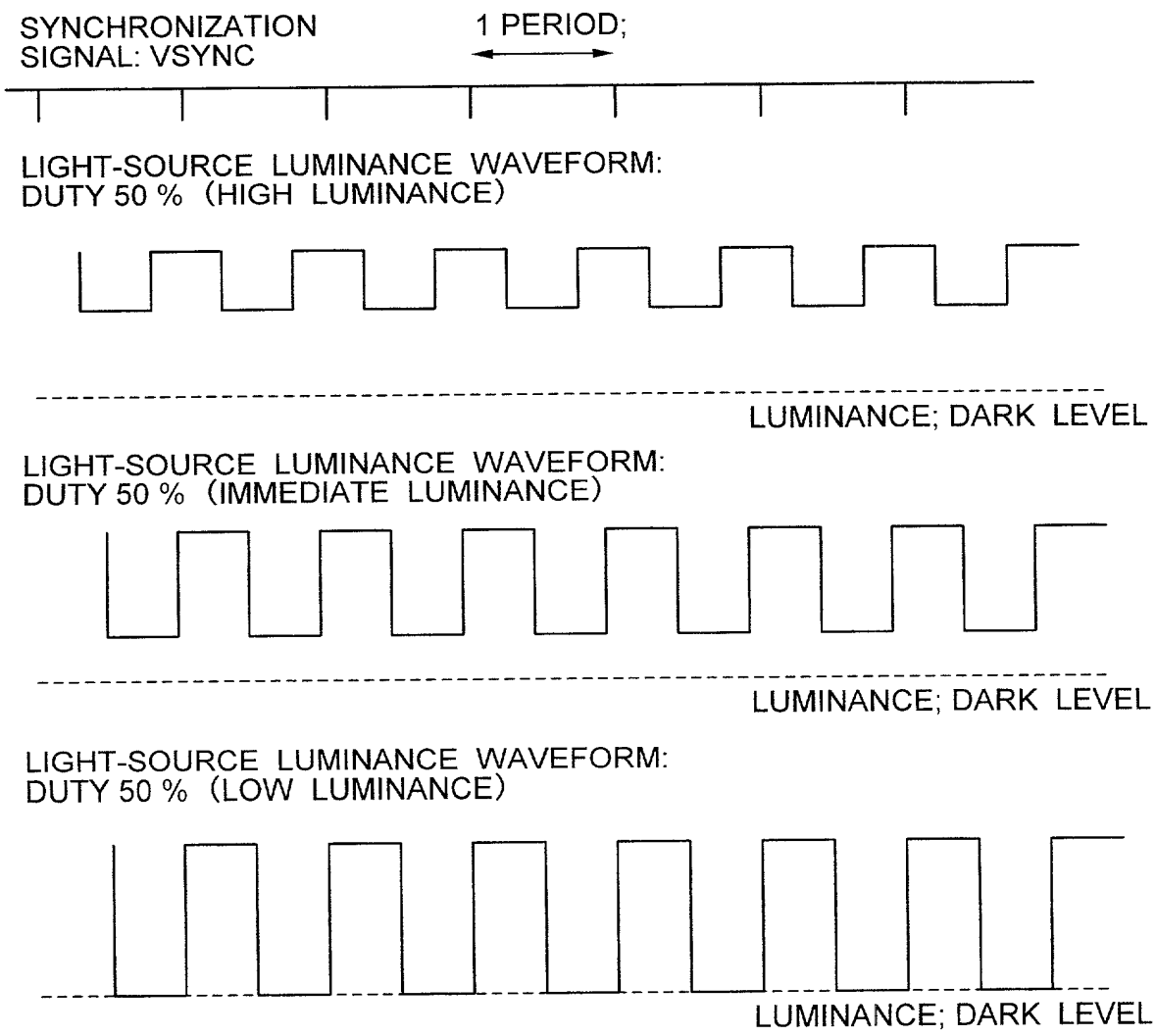


FIG. 11C



US 9,886,894 B2

FIG. 12



US 2006/0256054 A1

FIG. 13A

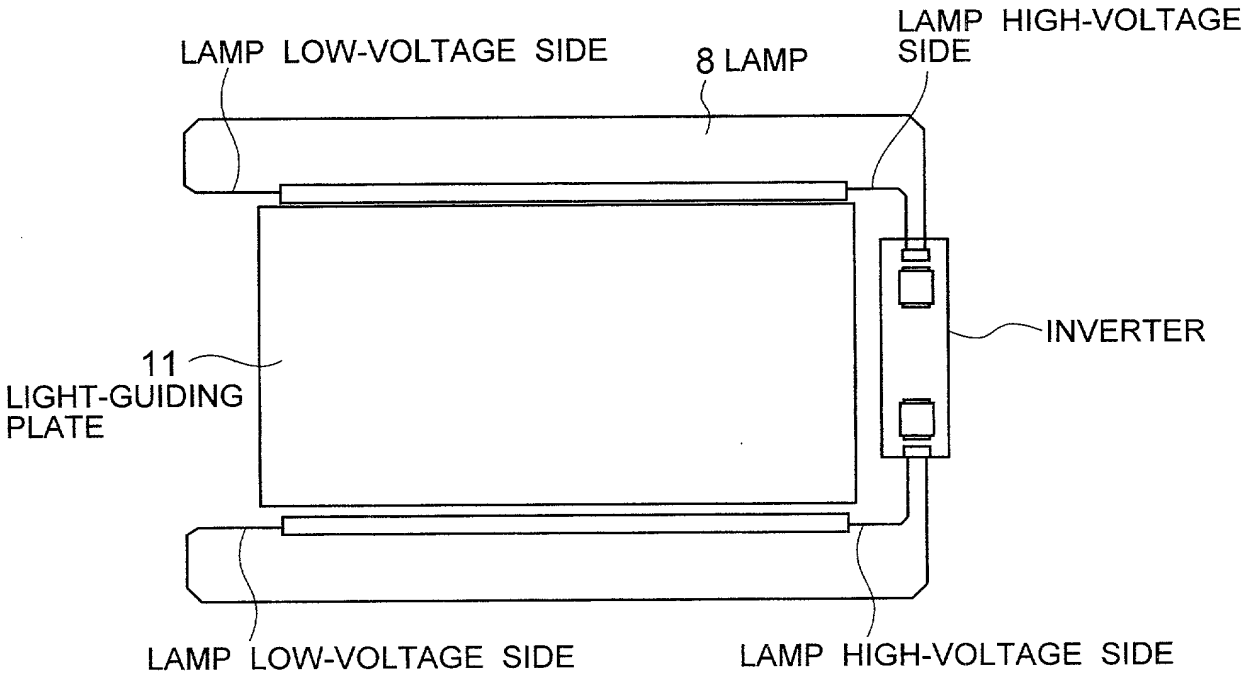
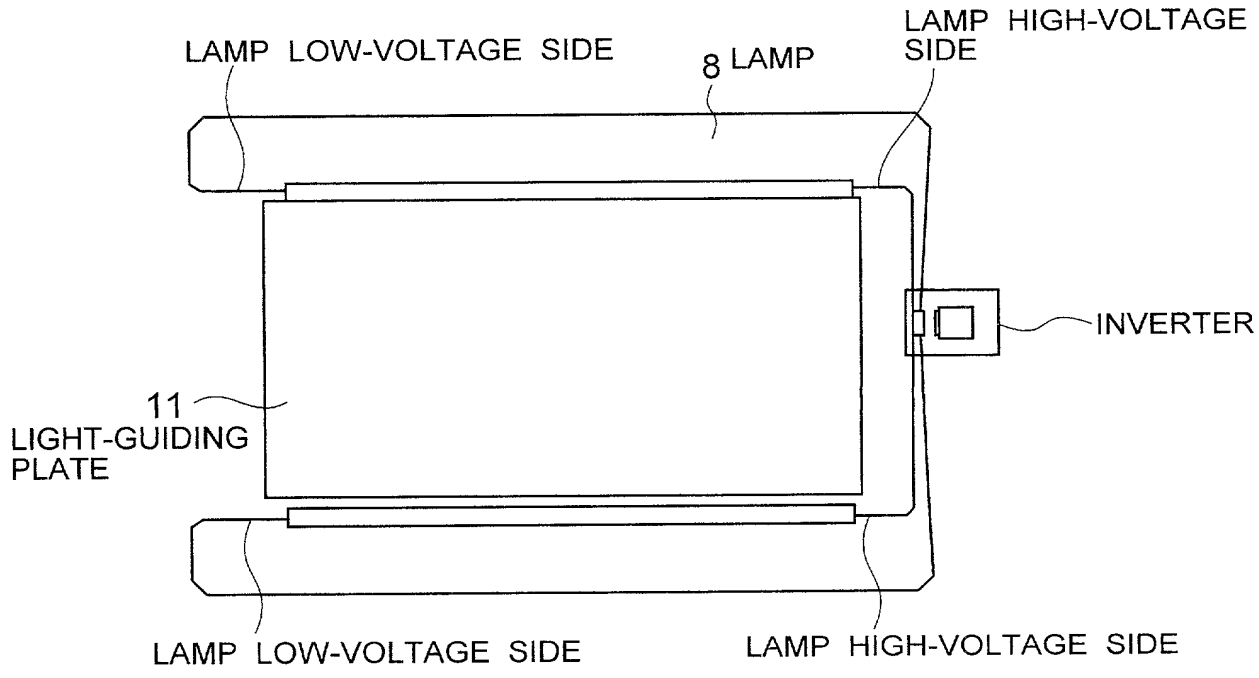


FIG. 13B



7095364 - 0522504

FIG. 14A

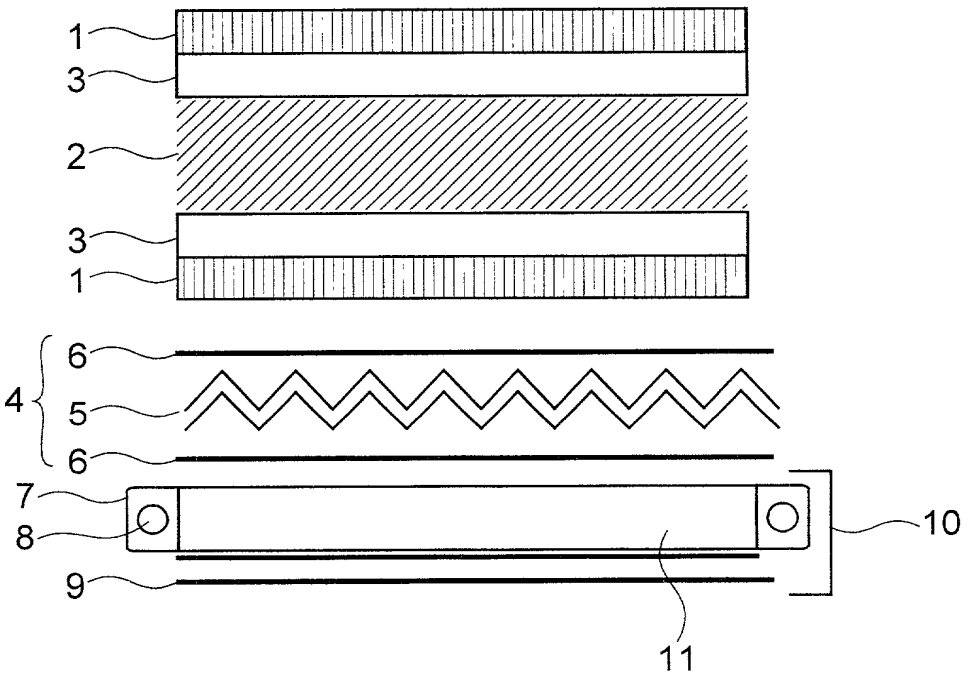


FIG. 14B

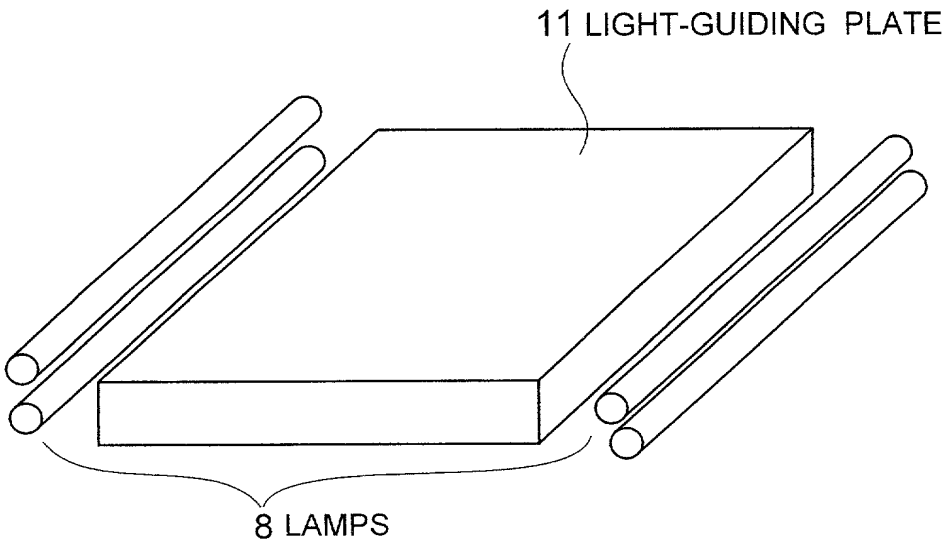


FIG. 15

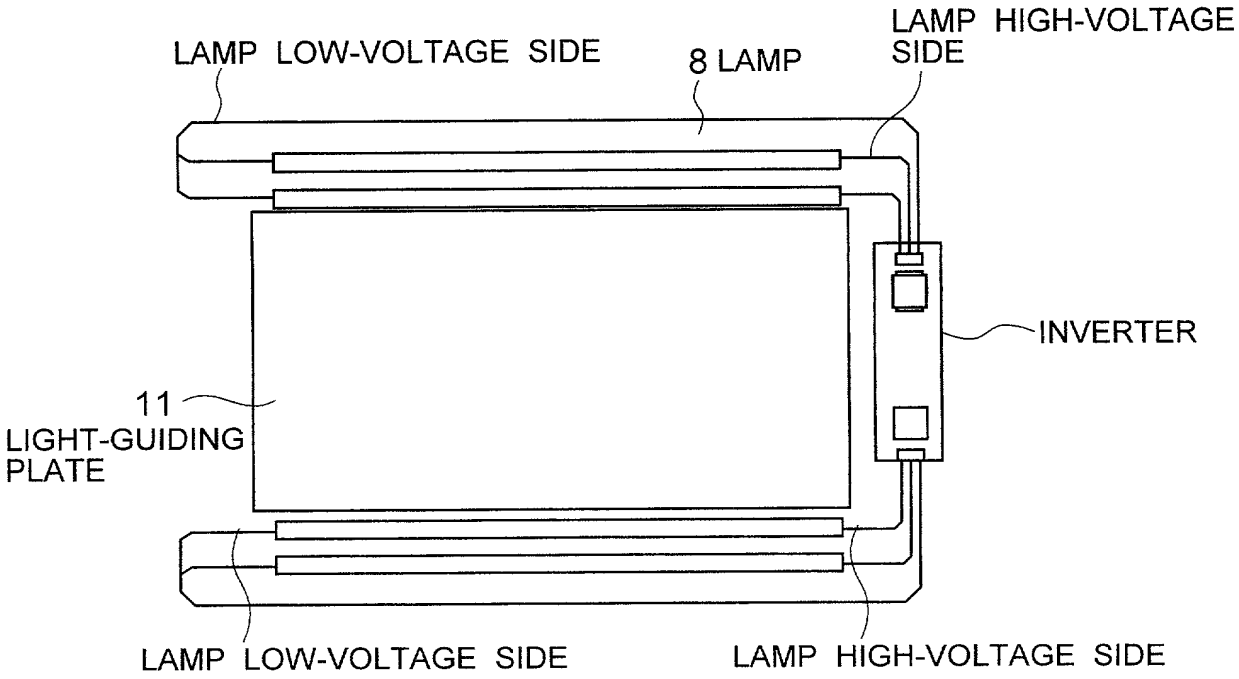
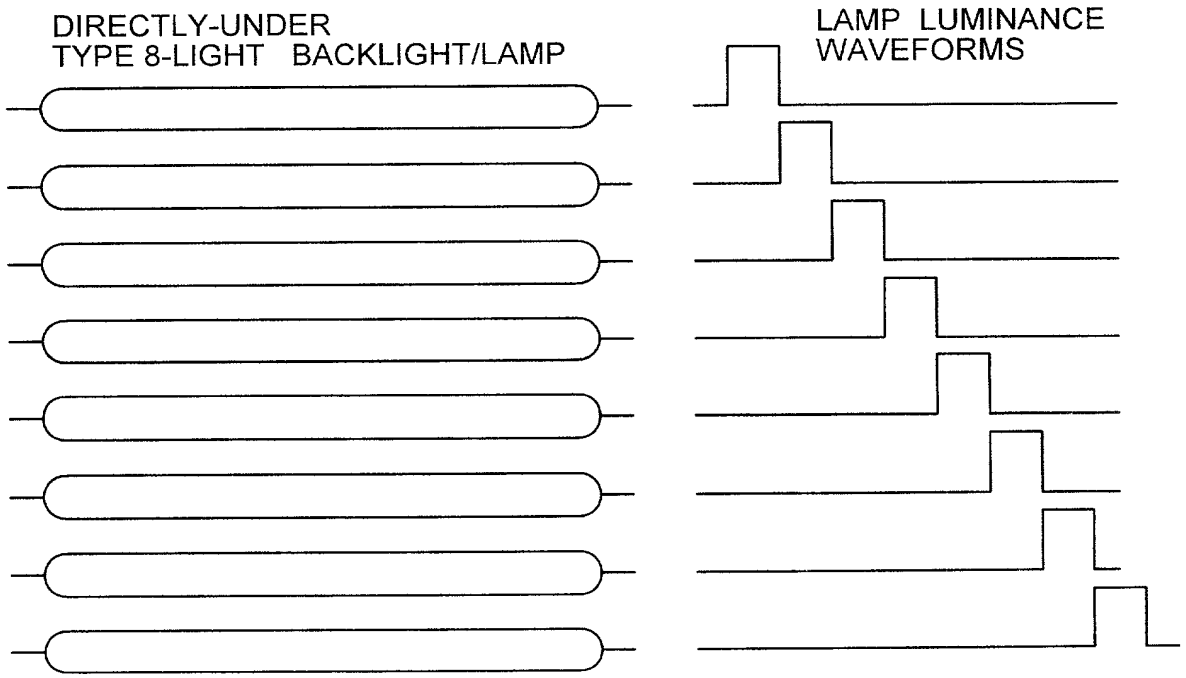
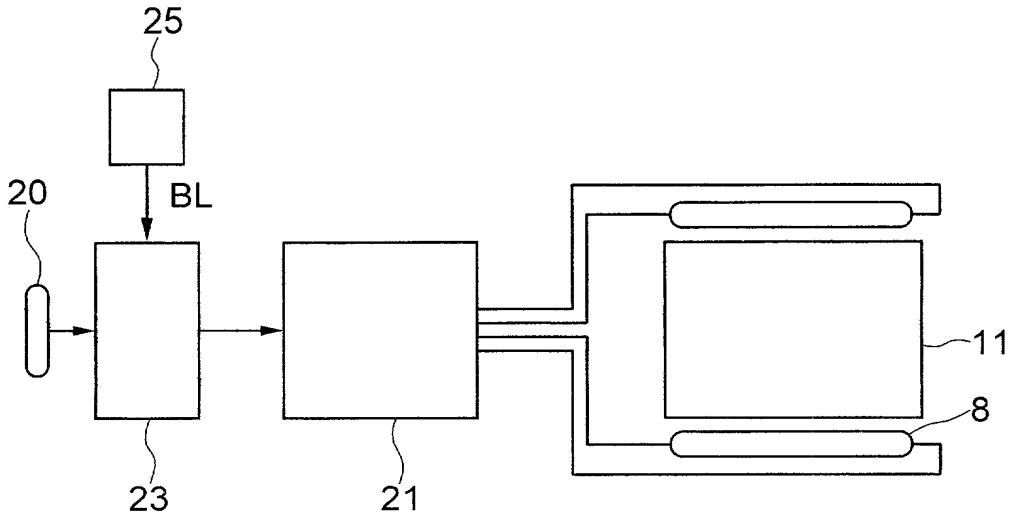


FIG. 16



09886541.060203

FIG. 17



US 9,869,941 B2

FIG. 18

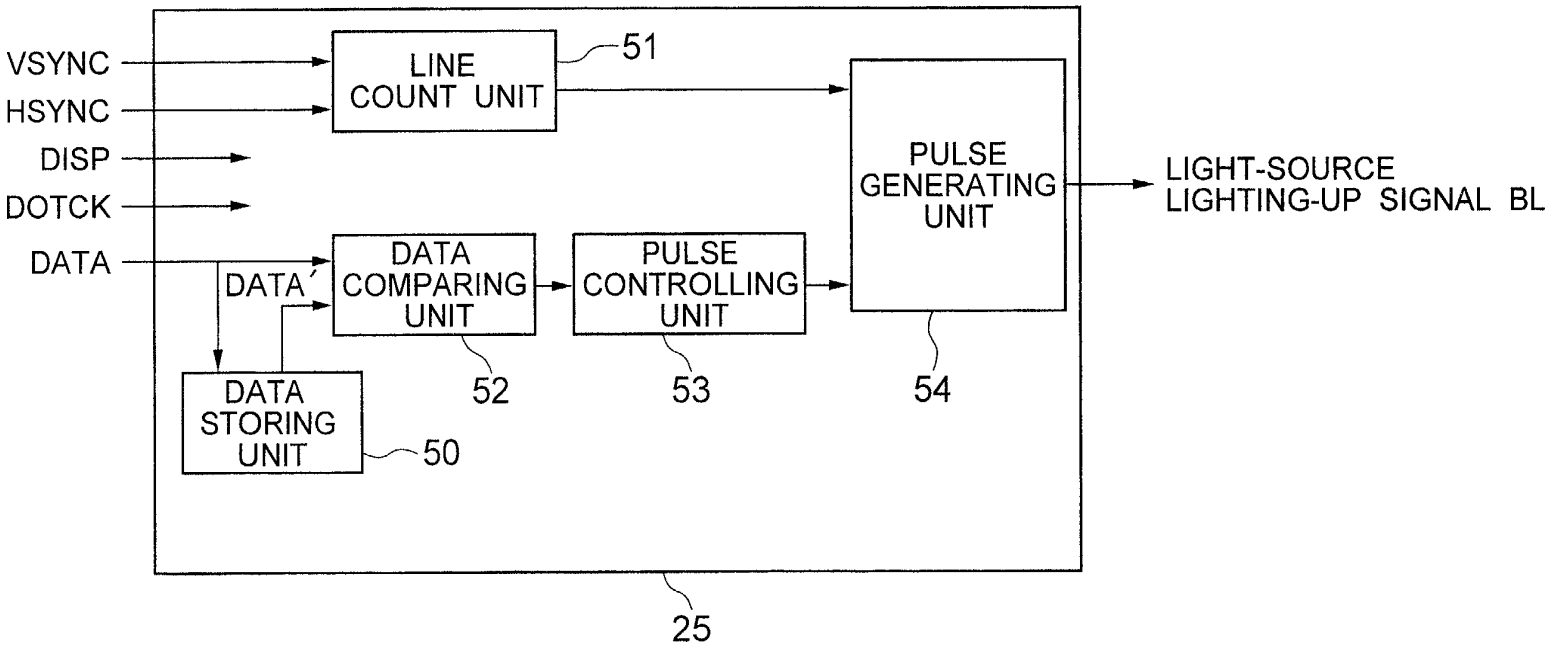
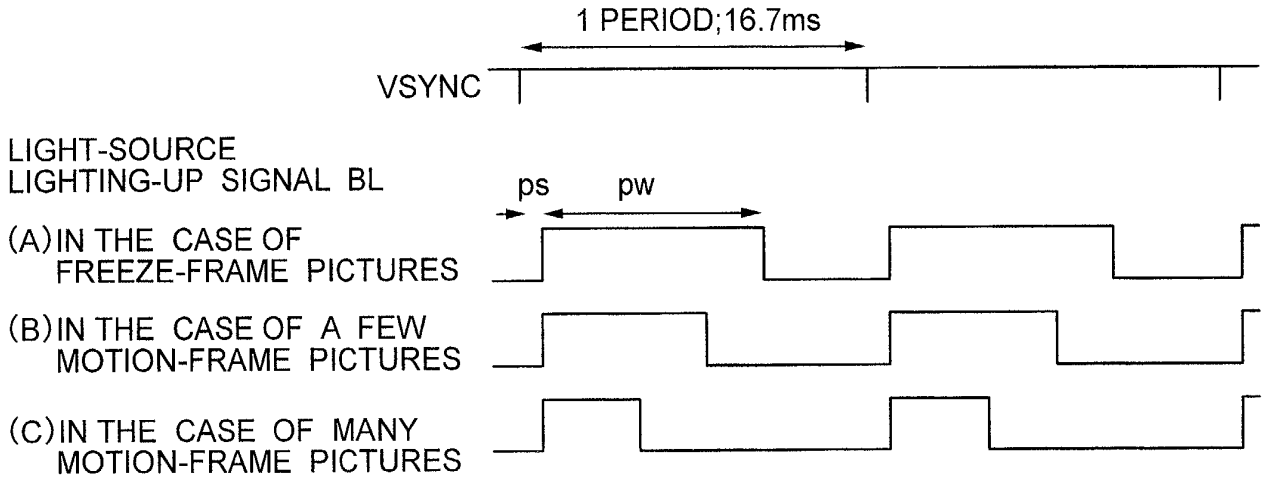
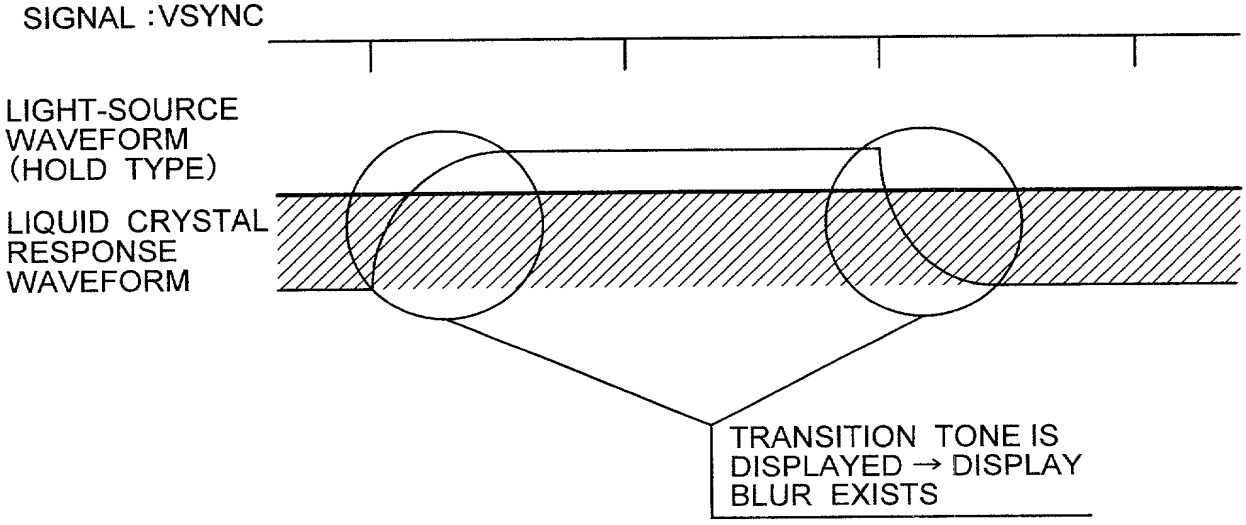

VSYNC
HSYNC
DISP
DOTCK
DATA
DATA'
LINE COUNT UNIT
51
DATA COMPARING UNIT
52
PULSE CONTROLLING UNIT
53
PULSE GENERATING UNIT
54
LIGHT-SOURCE LIGHTING-UP SIGNAL BL
DATA STORING UNIT
50
25

FIG. 19


1 PERIOD;16.7ms
VSYNC
LIGHT-SOURCE
LIGHTING-UP SIGNAL BL
ps
pw
(A) IN THE CASE OF
FREEZE-FRAME PICTURES
(B) IN THE CASE OF A FEW
MOTION-FRAME PICTURES
(C) IN THE CASE OF MANY
MOTION-FRAME PICTURES

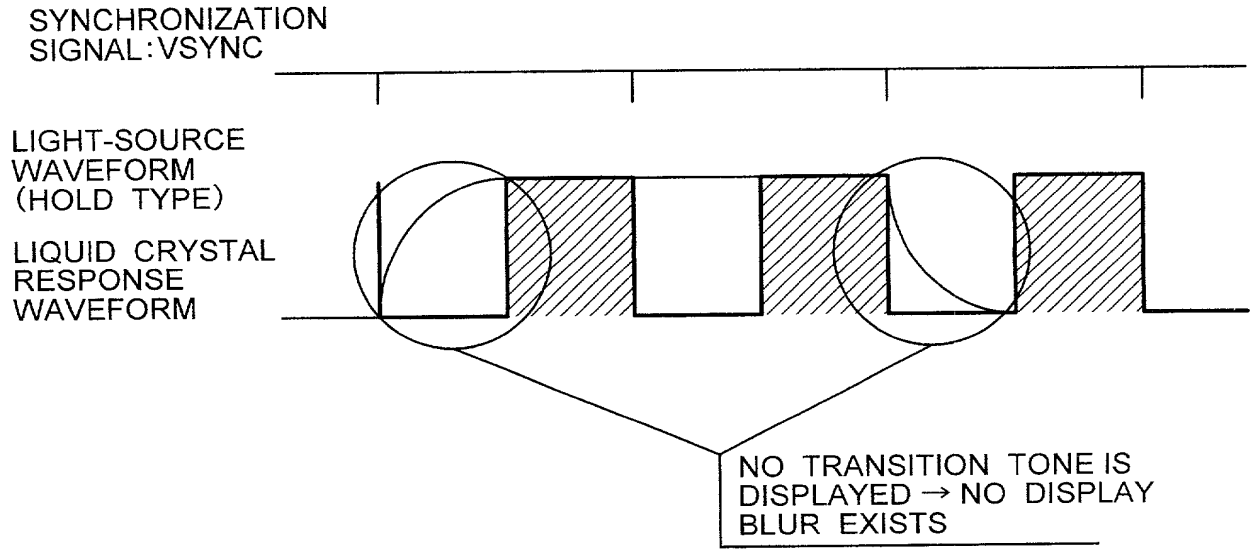
HOLD TYPE
LIGHT-EMISSION
IN THE PRIOR ART

FIG. 20A



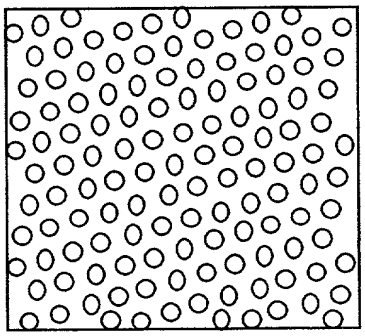
IMPULSE TYPE LIGHT-EMISSION
IN THE PRESENT DEVELOPMENT

FIG. 20B



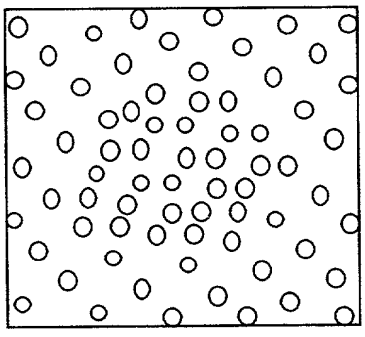
EP 0 962 904 A2 19990609

FIG. 21A



DISPLAY SCREEN DETECTION POINTS

FIG. 21B



DISPLAY SCREEN DETECTION POINTS

09868447.062601

FIG. 22

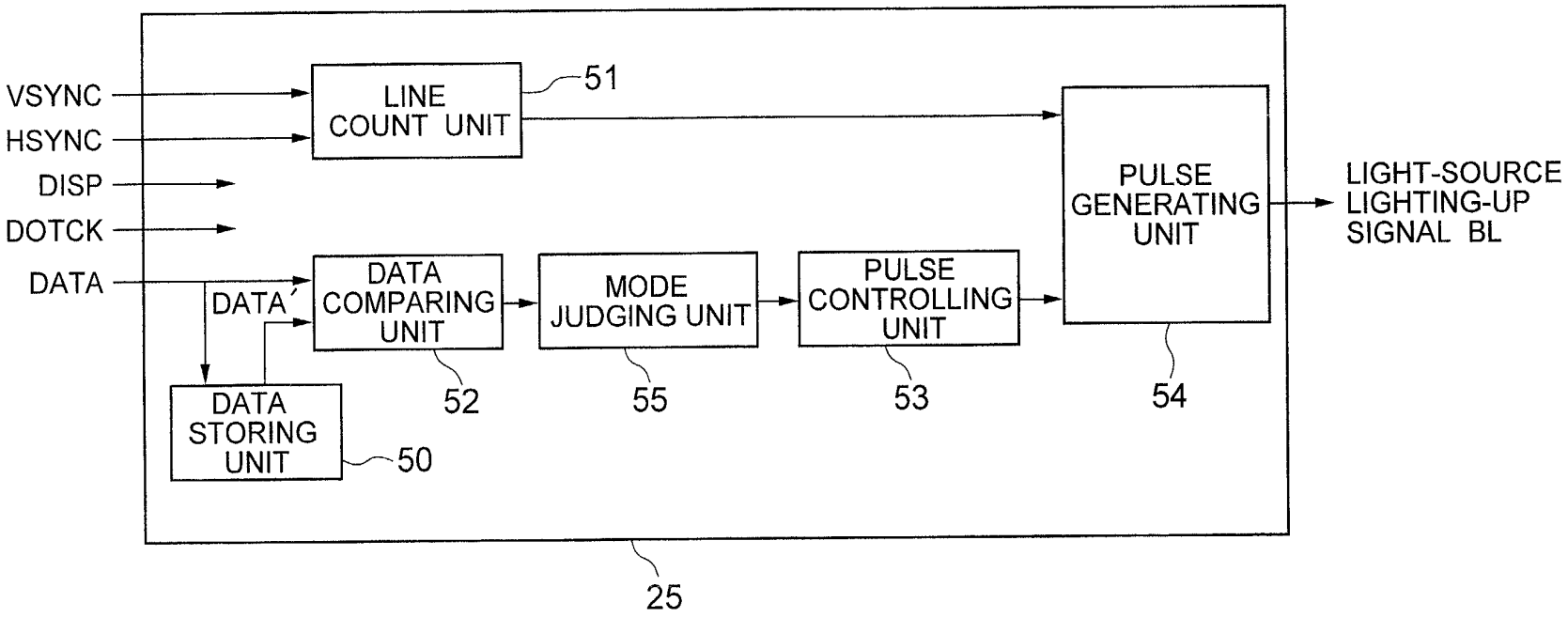

VSYNC
HSYNC
DISP
DOTCK
DATA
DATA'
LINE COUNT UNIT
51
DATA COMPARING UNIT
52
MODE JUDGING UNIT
55
PULSE CONTROLLING UNIT
53
PULSE GENERATING UNIT
54
LIGHT-SOURCE LIGHTING-UP SIGNAL BL
DATA STORING UNIT
50
25

FIG. 23

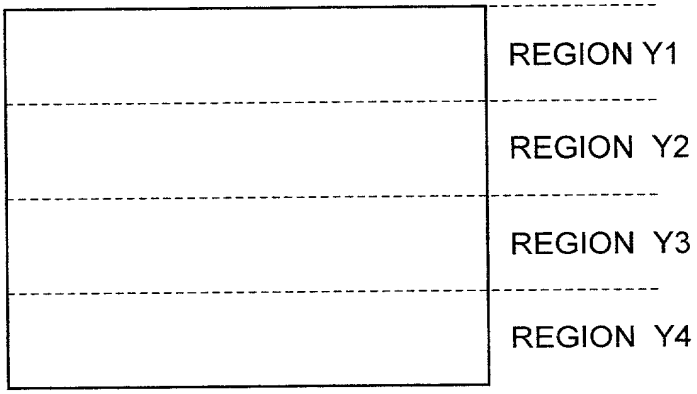

REGION Y1
REGION Y2
REGION Y3
REGION Y4

FIG. 24

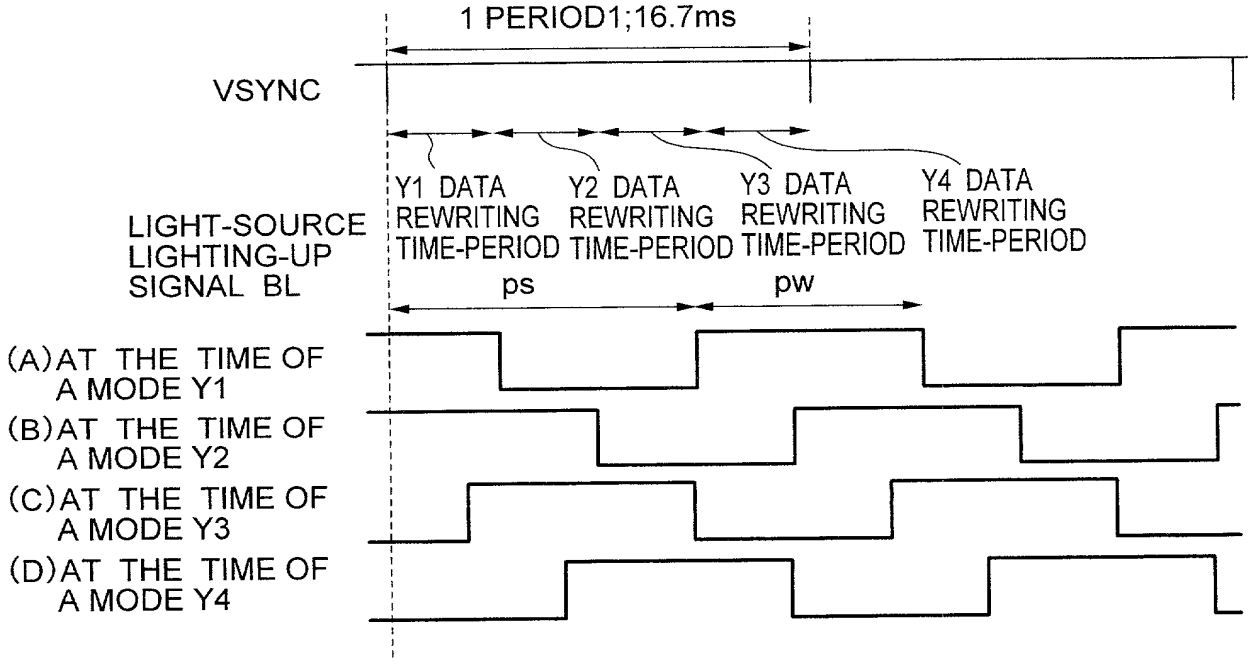

1 PERIOD1;16.7ms
VSYNC
Y1 DATA REWRITING TIME-PERIOD
Y2 DATA REWRITING TIME-PERIOD
Y3 DATA REWRITING TIME-PERIOD
Y4 DATA REWRITING TIME-PERIOD
LIGHT-SOURCE LIGHTING-UP SIGNAL BL
ps
pw
(A)AT THE TIME OF A MODE Y1
(B)AT THE TIME OF A MODE Y2
(C)AT THE TIME OF A MODE Y3
(D)AT THE TIME OF A MODE Y4

FIG. 25

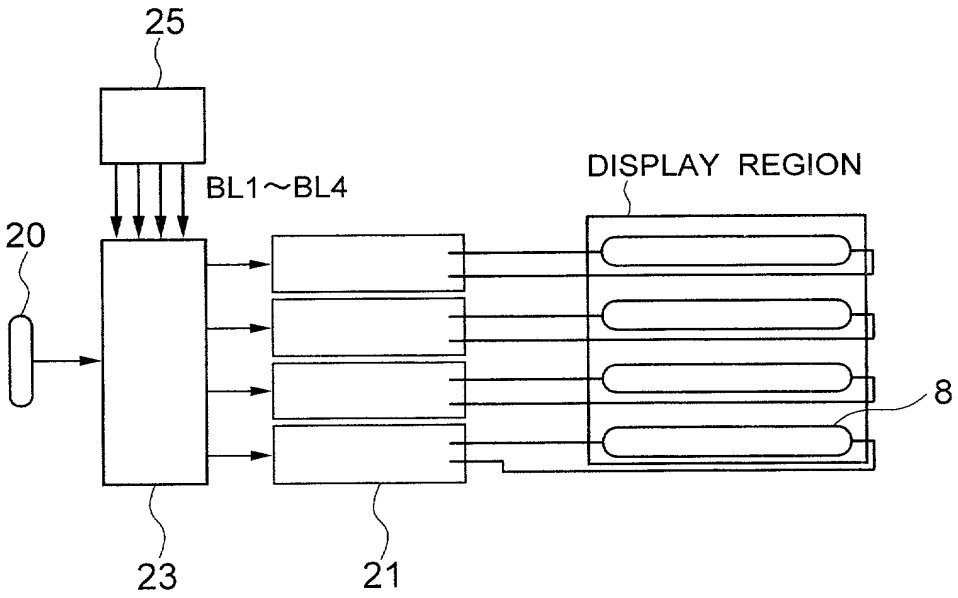


FIG. 26

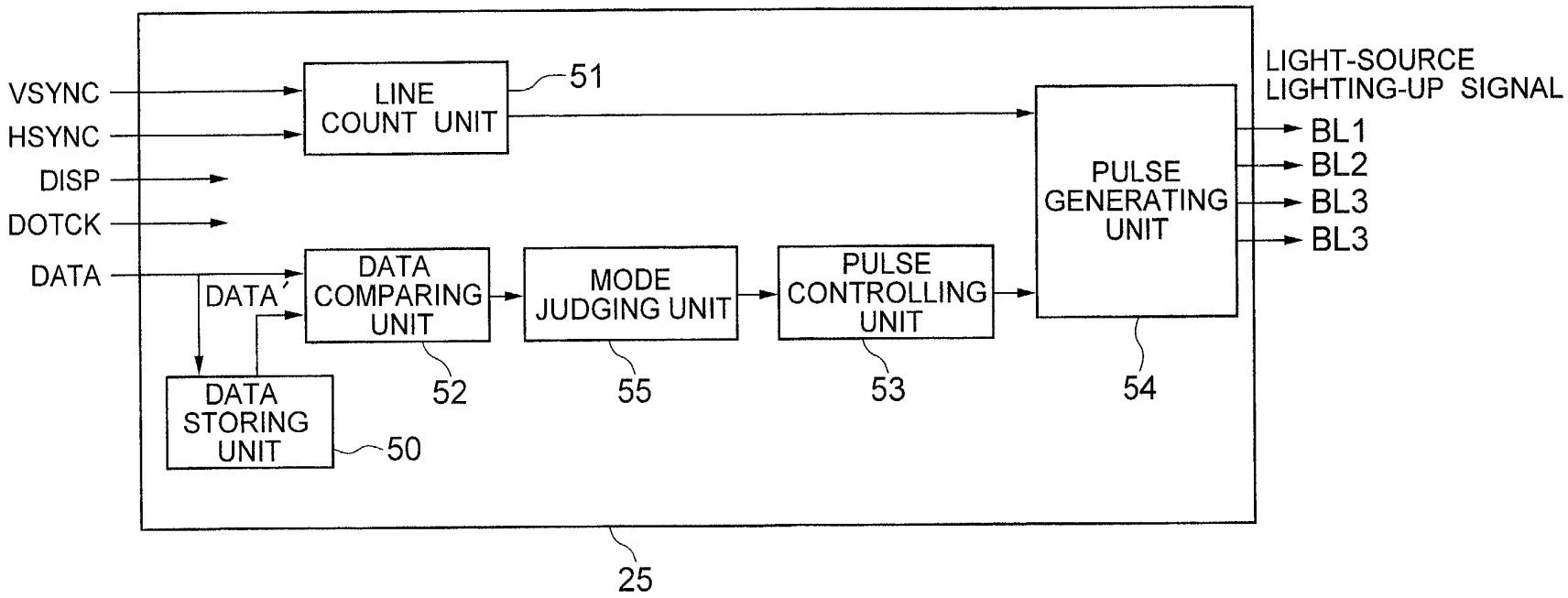
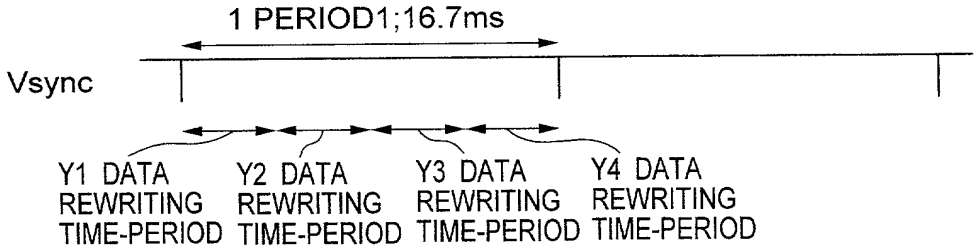
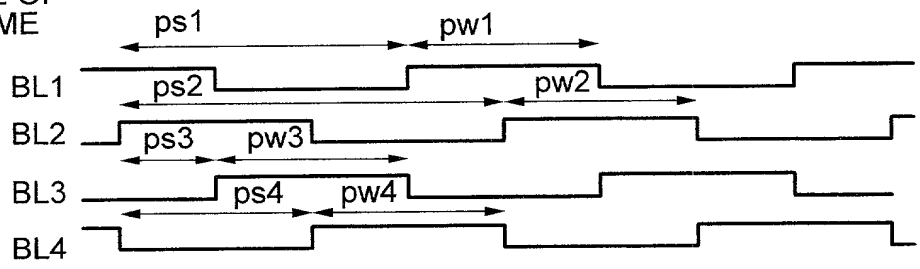

VSYNC
HSYNC
DISP
DOTCK
DATA
DATA'
LINE COUNT UNIT
51
DATA COMPARING UNIT
52
MODE JUDGING UNIT
55
PULSE CONTROLLING UNIT
53
PULSE GENERATING UNIT
54
DATA STORING UNIT
50
25
LIGHT-SOURCE LIGHTING-UP SIGNAL
BL1
BL2
BL3
BL3

FIG. 27

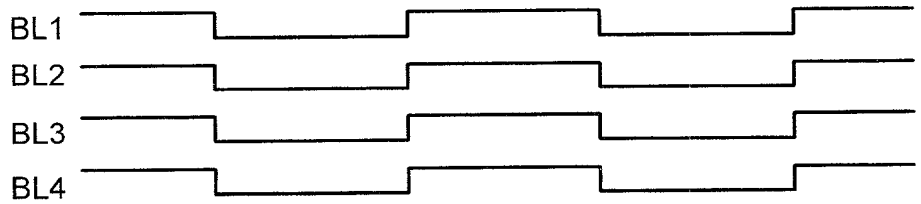


LIGHT-SOURCE LIGHTING-UP

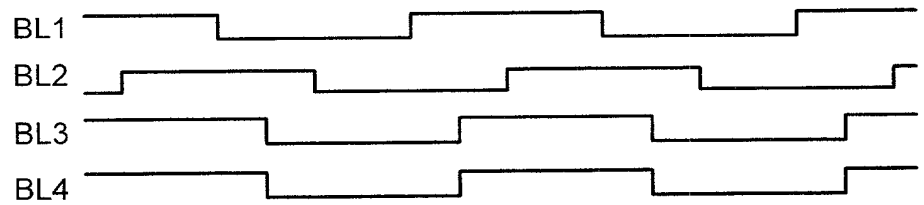
(A) AT THE TIME OF FREEZE-FRAME PICTURES



(B) AT THE TIME OF A MODE Y1



(C) AT THE TIME OF A MODE Y1, Y2



(D) AT THE TIME OF A MODE Y1, Y3

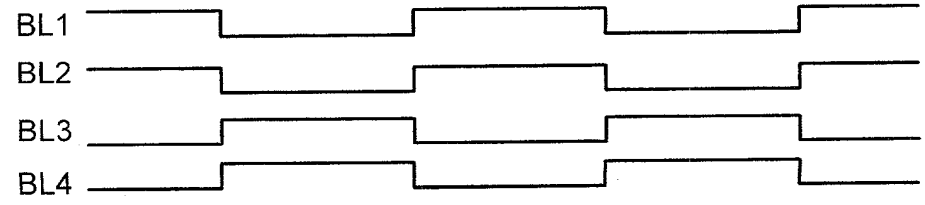


FIG. 28

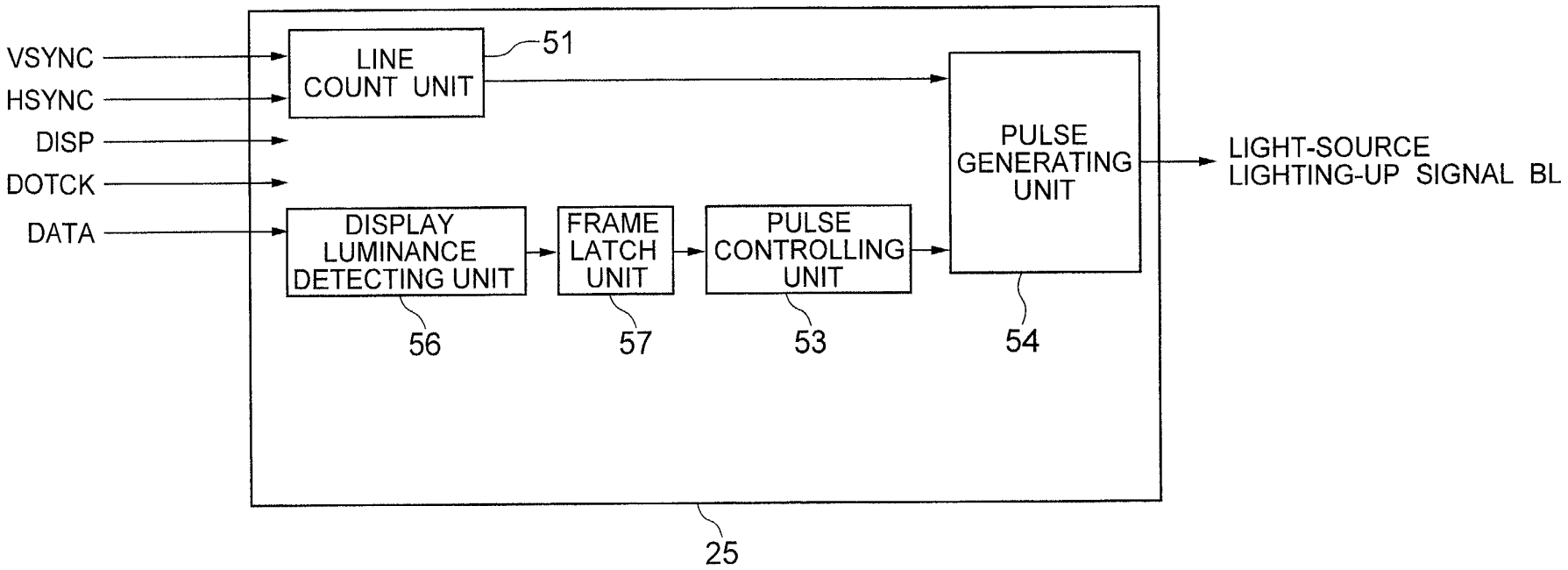

VSYNC
HSYNC
DISP
DOTCK
DATA
LINE COUNT UNIT
51
DISPLAY LUMINANCE DETECTING UNIT
FRAME LATCH UNIT
PULSE CONTROLLING UNIT
PULSE GENERATING UNIT
LIGHT-SOURCE LIGHTING-UP SIGNAL BL
56
57
53
54
25

FIG. 29

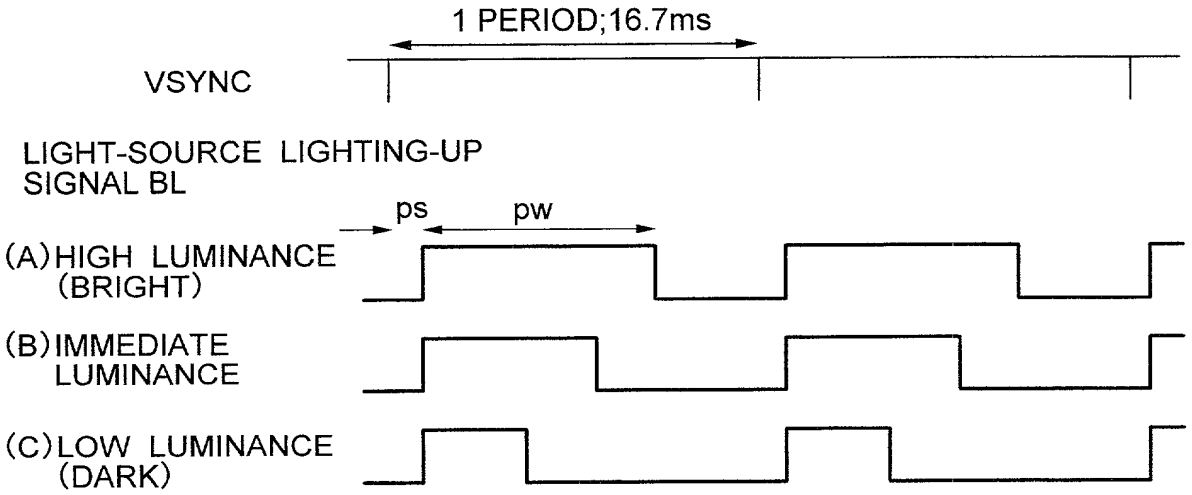

1 PERIOD;16.7ms
VSYNC
LIGHT-SOURCE LIGHTING-UP SIGNAL BL
ps
pw
(A) HIGH LUMINANCE (BRIGHT)
(B) IMMEDIATE LUMINANCE
(C) LOW LUMINANCE (DARK)

FIG. 30

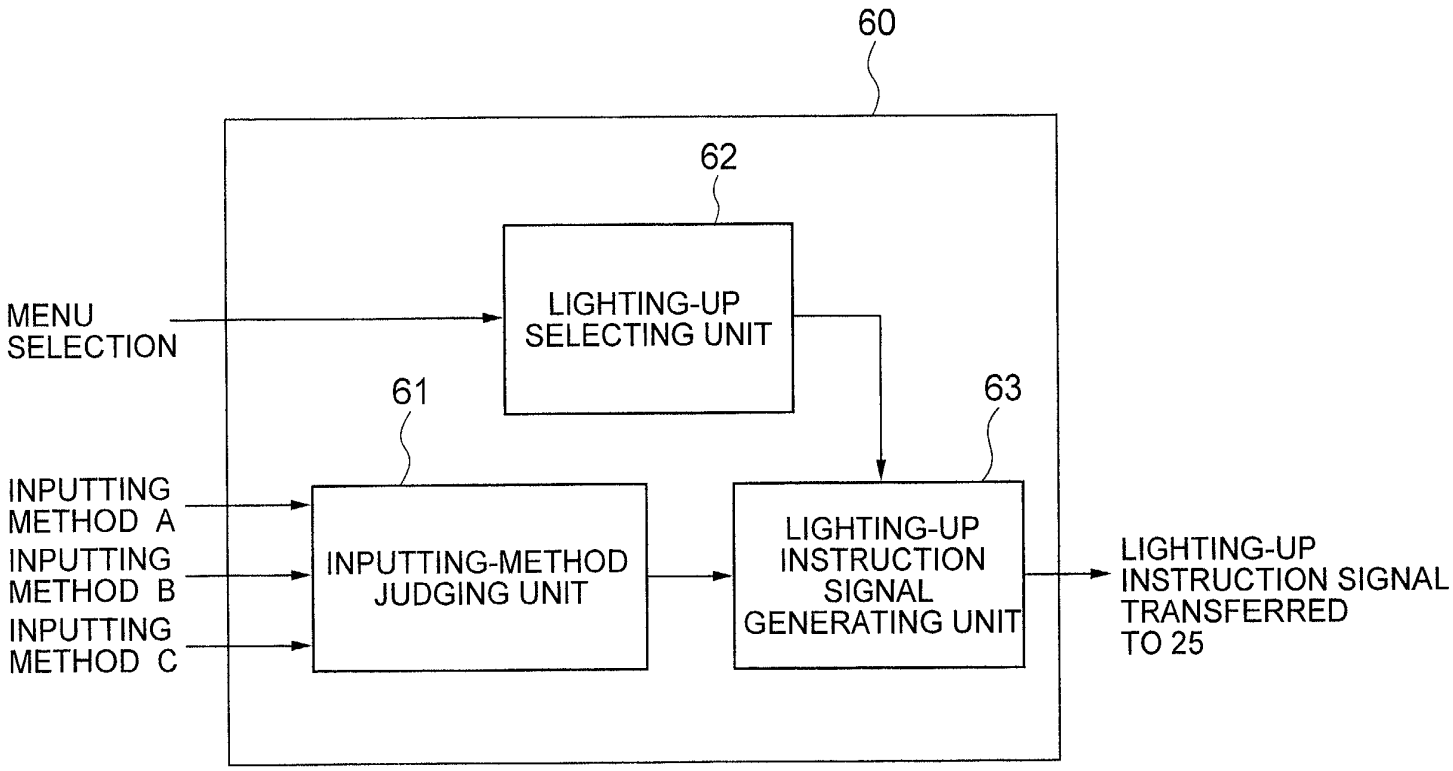

60
62
LIGHTING-UP SELECTING UNIT
MENU SELECTION
61
63
INPUTTING METHOD A
INPUTTING METHOD B
INPUTTING METHOD C
INPUTTING-METHOD JUDGING UNIT
LIGHTING-UP INSTRUCTION SIGNAL GENERATING UNIT
LIGHTING-UP INSTRUCTION SIGNAL TRANSFERRED TO 25

FIG. 31

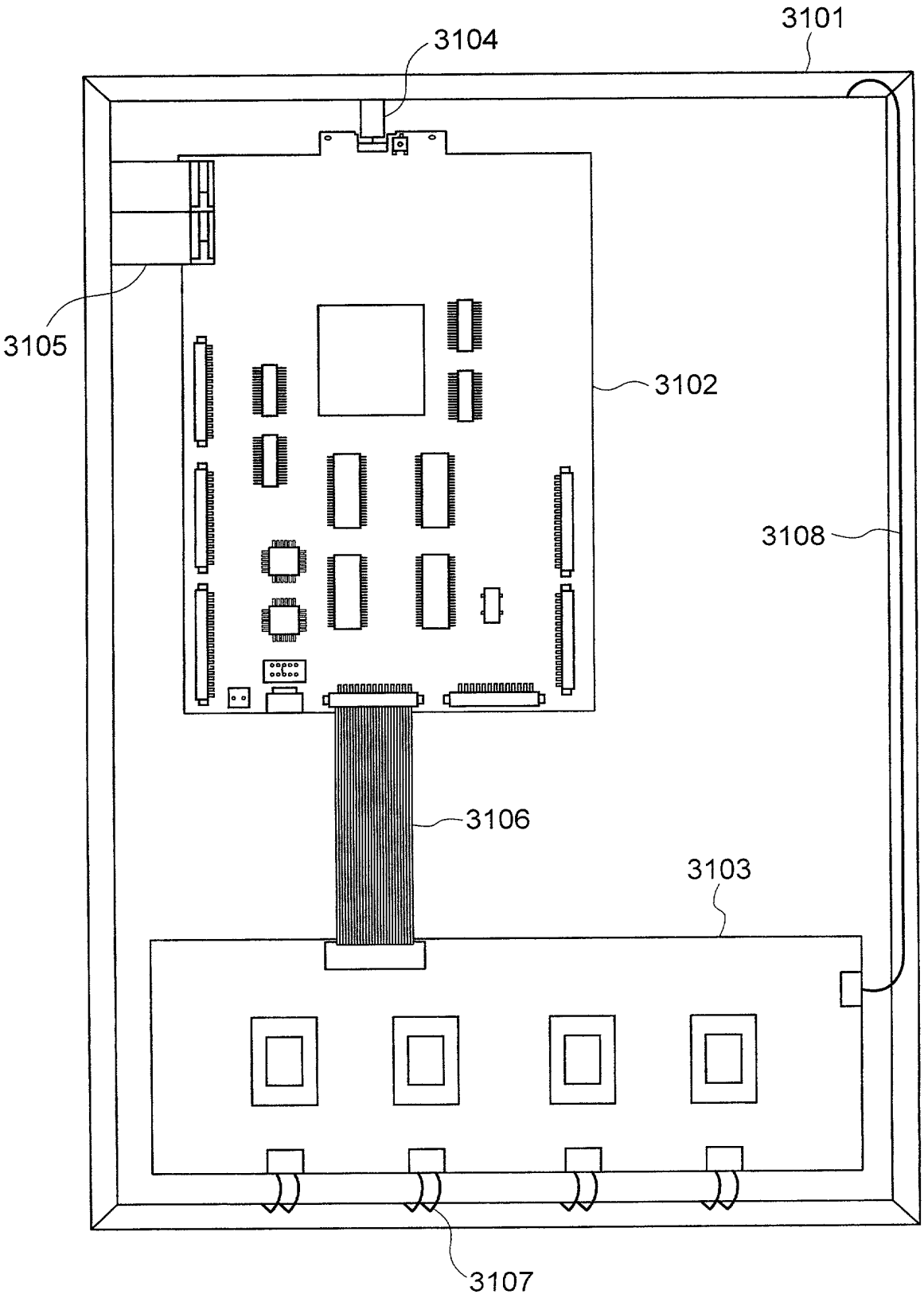


FIG. 32

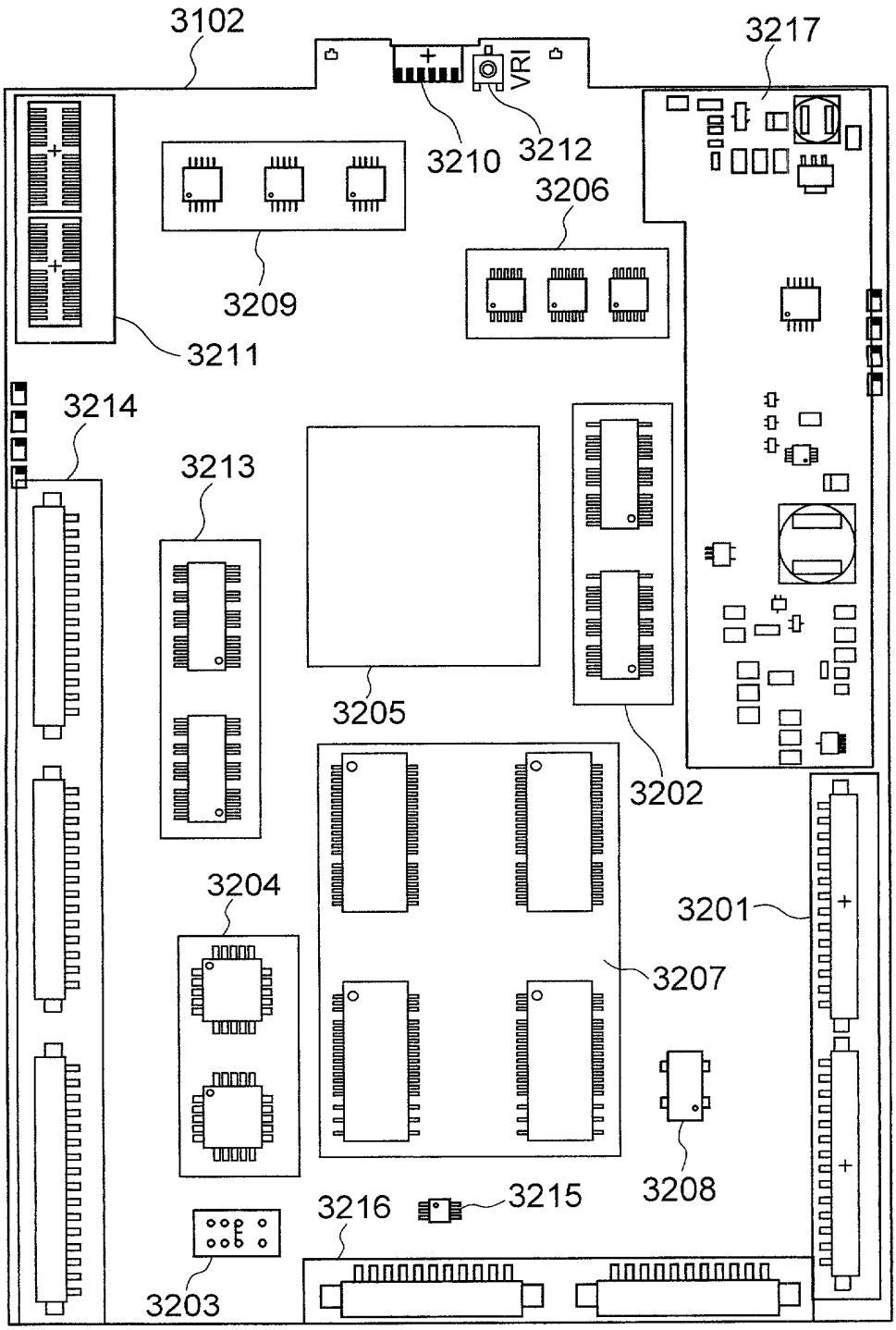

3102
3217
VRI
3210
3212
3206
3209
3211
3214
3213
3205
3202
3204
3201
3207
3208
3216
3215
3203

FIG. 33

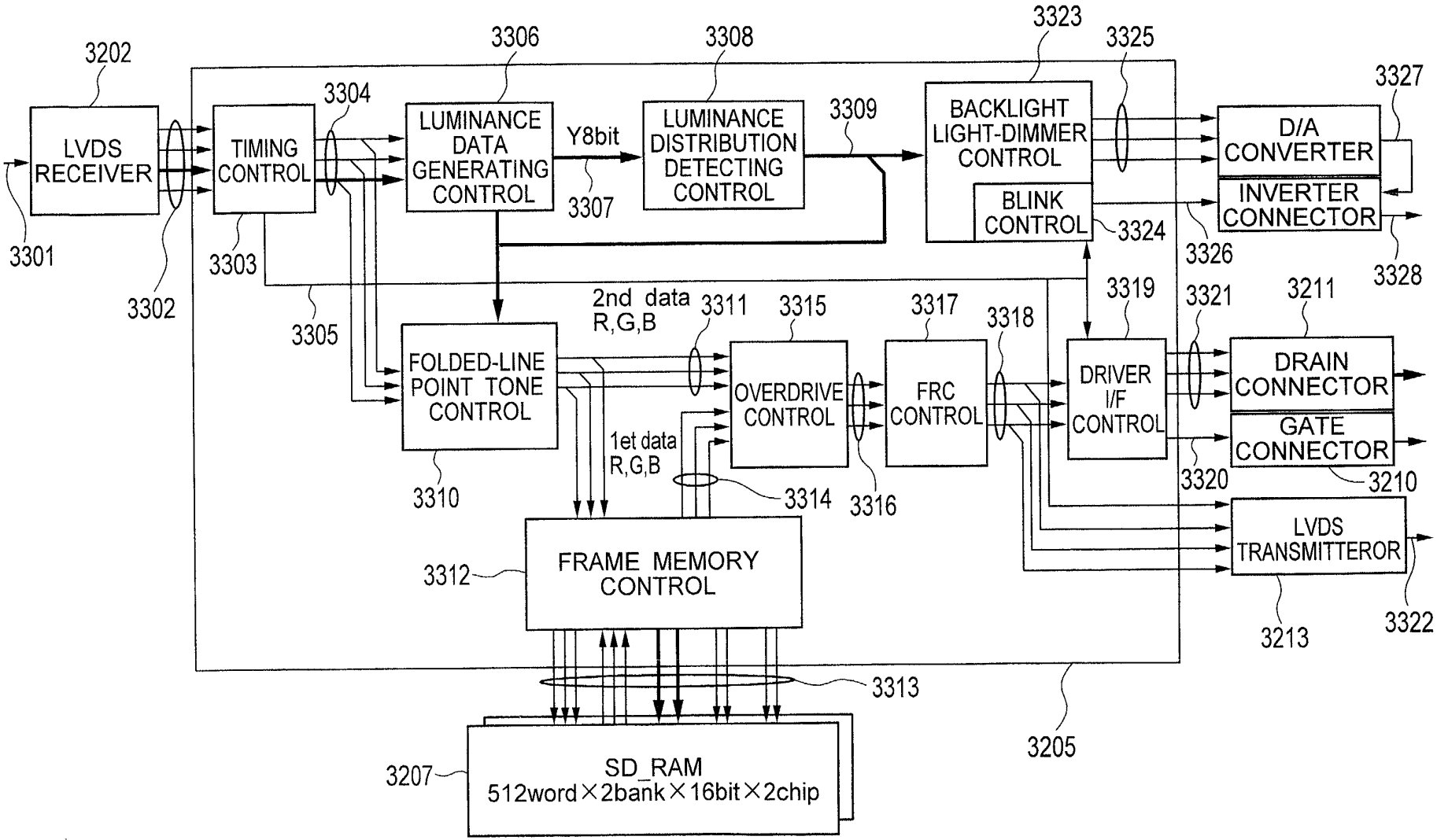

3202
LVDS RECEIVER
3301
3302
TIMING CONTROL
3303
3304
3305
3306
LUMINANCE DATA GENERATING CONTROL
Y8bit
3307
3308
LUMINANCE DISTRIBUTION DETECTING CONTROL
3309
3323
BACKLIGHT LIGHT-DIMMER CONTROL
BLINK CONTROL
3324
3325
3326
D/A CONVERTER
INVERTER CONNECTOR
3327
3328
2nd data R,G,B
3311
FOLDED-LINE POINT TONE CONTROL
3310
1et data R,G,B
3314
3315
OVERDRIVE CONTROL
3316
3317
FRC CONTROL
3318
3319
DRIVER I/F CONTROL
3320
3321
3211
DRAIN CONNECTOR
GATE CONNECTOR
3210
LVDS TRANSMITTEROR
3213
3322
3312
FRAME MEMORY CONTROL
3313
3205
3207
SD_RAM
512word×2bank×16bit×2chip

FIG. 34

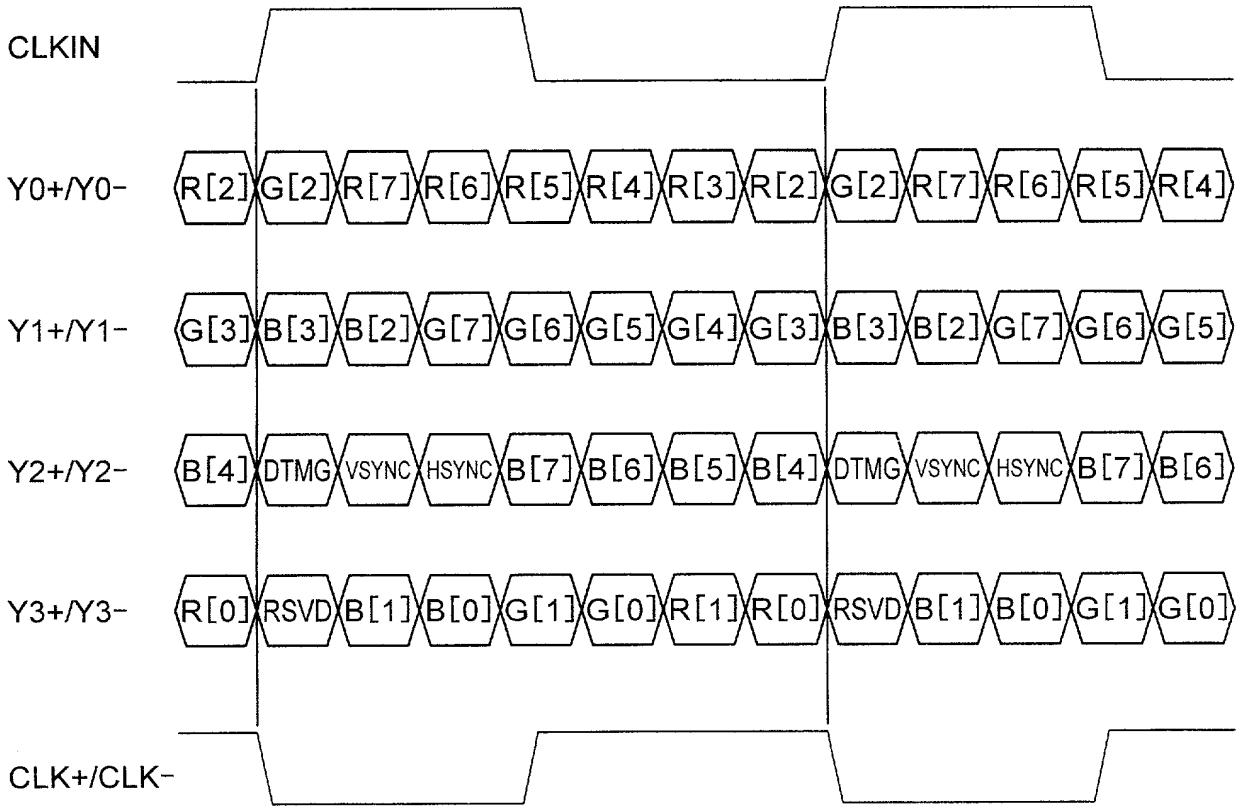


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FIG. 35

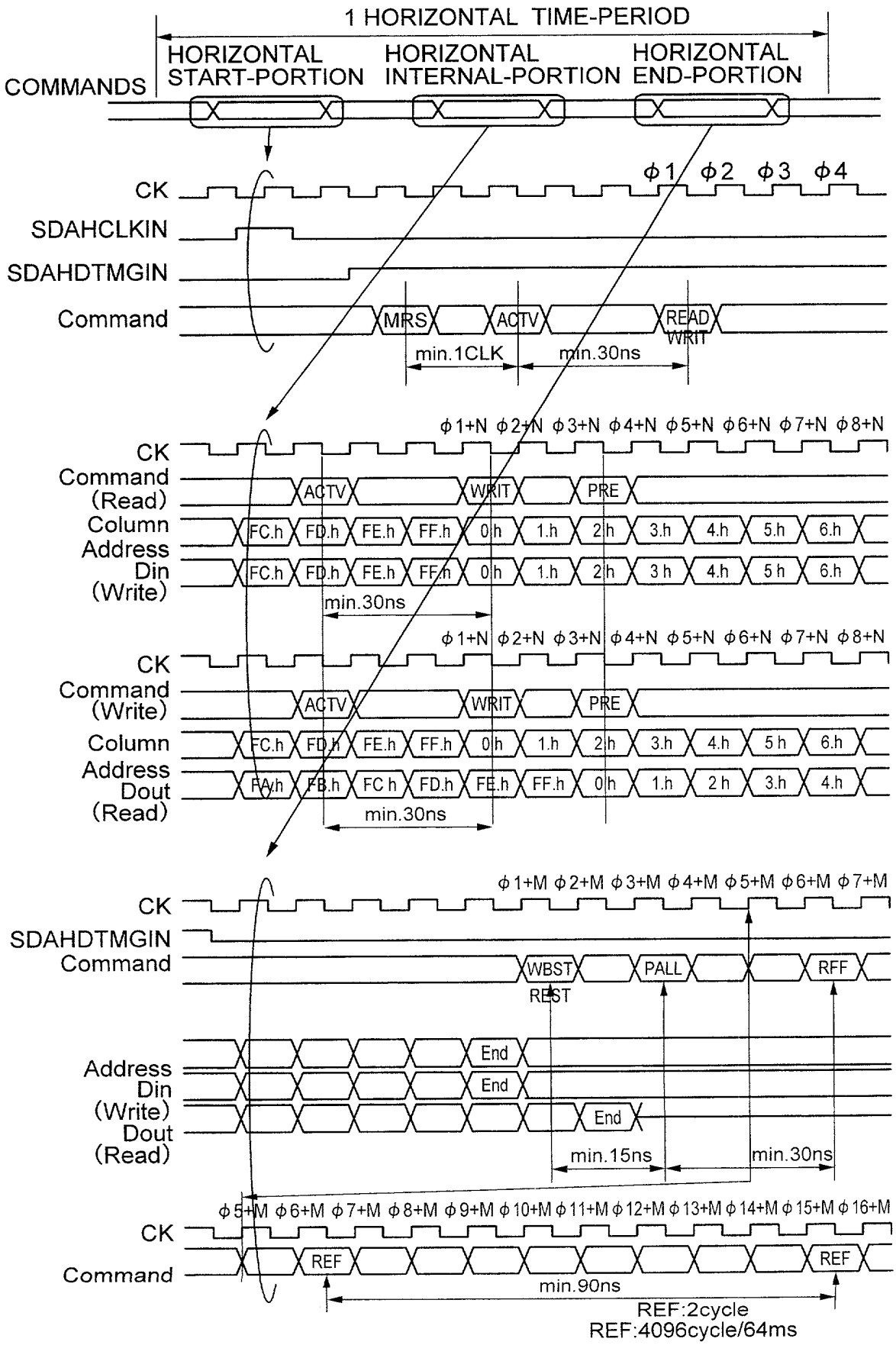

1 HORIZONTAL TIME-PERIOD
HORIZONTAL START-PORTION
HORIZONTAL INTERNAL-PORTION
HORIZONTAL END-PORTION
COMMANDS
CK
SDAHCLKIN
SDAHDTMGIN
Command
MRS
ACTV
READ WRIT
min.1CLK
min.30ns
φ1 φ2 φ3 φ4
φ1+N φ2+N φ3+N φ4+N φ5+N φ6+N φ7+N φ8+N
CK
Command (Read)
Column Address Din (Write)
ACTV
WRIT
PRE
FC.h FD.h FE.h FF.h 0h 1.h 2h 3.h 4.h 5.h 6.h
FC.h FD.h FE.h FF.h 0h 1.h 2h 3h 4.h 5h 6.h
min.30ns
CK
Command (Write)
Column Address Dout (Read)
FA.h FB.h FC h FD.h FE.h FF.h 0h 1.h 2 h 3.h 4.h
min.30ns
φ1+M φ2+M φ3+M φ4+M φ5+M φ6+M φ7+M
CK
SDAHDTMGIN
Command
WBST
REST
PALL
RFF
Address Din (Write) Dout (Read)
End
min.15ns
min.30ns
φ5+M φ6+M φ7+M φ8+M φ9+M φ10+M φ11+M φ12+M φ13+M φ14+M φ15+M φ16+M
CK
Command
REF
min.90ns
REF:2cycle
REF:4096cycle/64ms

FIG. 36

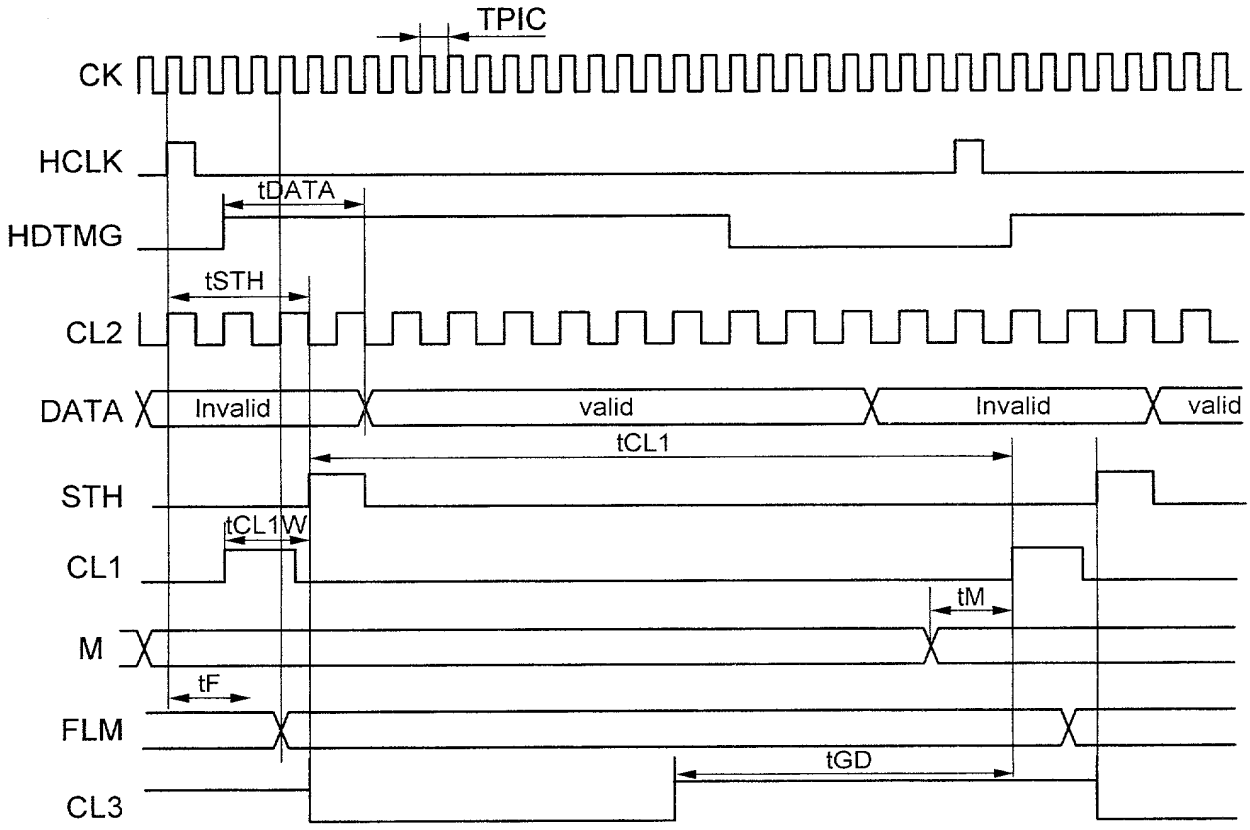

TPIC
CK
HCLK
tDATA
HDTMG
tSTH
CL2
DATA
Invalid
valid
Invalid
valid
tCL1
STH
tCL1W
CL1
tM
M
tF
FLM
tGD
CL3

FIG. 37

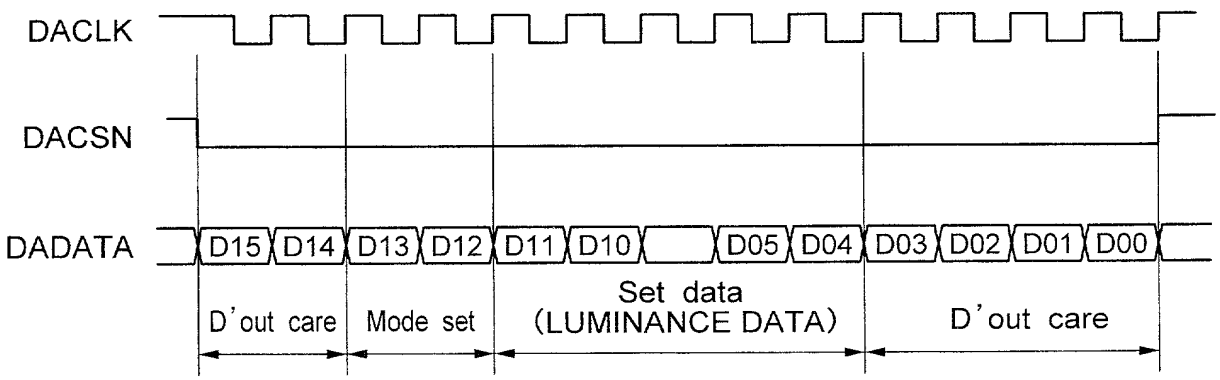

DACLK
DACSN
DADATA
D15
D14
D13
D12
D11
D10
D05
D04
D03
D02
D01
D00
D'out care
Mode set
Set data
(LUMINANCE DATA)
D'out care

FIG. 38

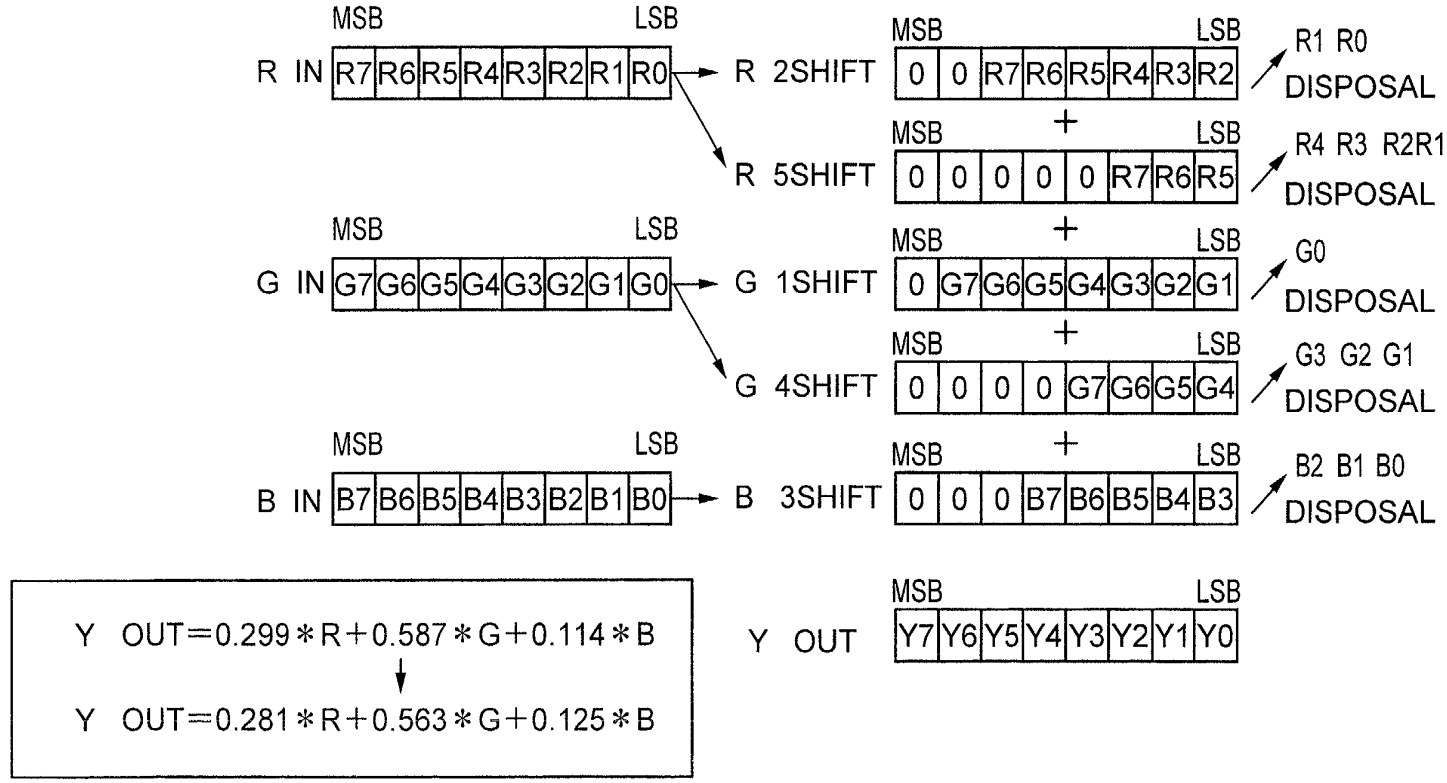

MSB
LSB
R IN R7 R6 R5 R4 R3 R2 R1 R0
R 2SHIFT 0 0 R7 R6 R5 R4 R3 R2
R1 R0 DISPOSAL
+
R 5SHIFT 0 0 0 0 0 R7 R6 R5
R4 R3 R2R1 DISPOSAL
G IN G7 G6 G5 G4 G3 G2 G1 G0
G 1SHIFT 0 G7 G6 G5 G4 G3 G2 G1
G0 DISPOSAL
G 4SHIFT 0 0 0 0 G7 G6 G5 G4
G3 G2 G1 DISPOSAL
B IN B7 B6 B5 B4 B3 B2 B1 B0
B 3SHIFT 0 0 0 B7 B6 B5 B4 B3
B2 B1 B0 DISPOSAL
Y OUT=0.299*R+0.587*G+0.114*B
Y OUT=0.281*R+0.563*G+0.125*B
Y OUT Y7 Y6 Y5 Y4 Y3 Y2 Y1 Y0

FIG. 39

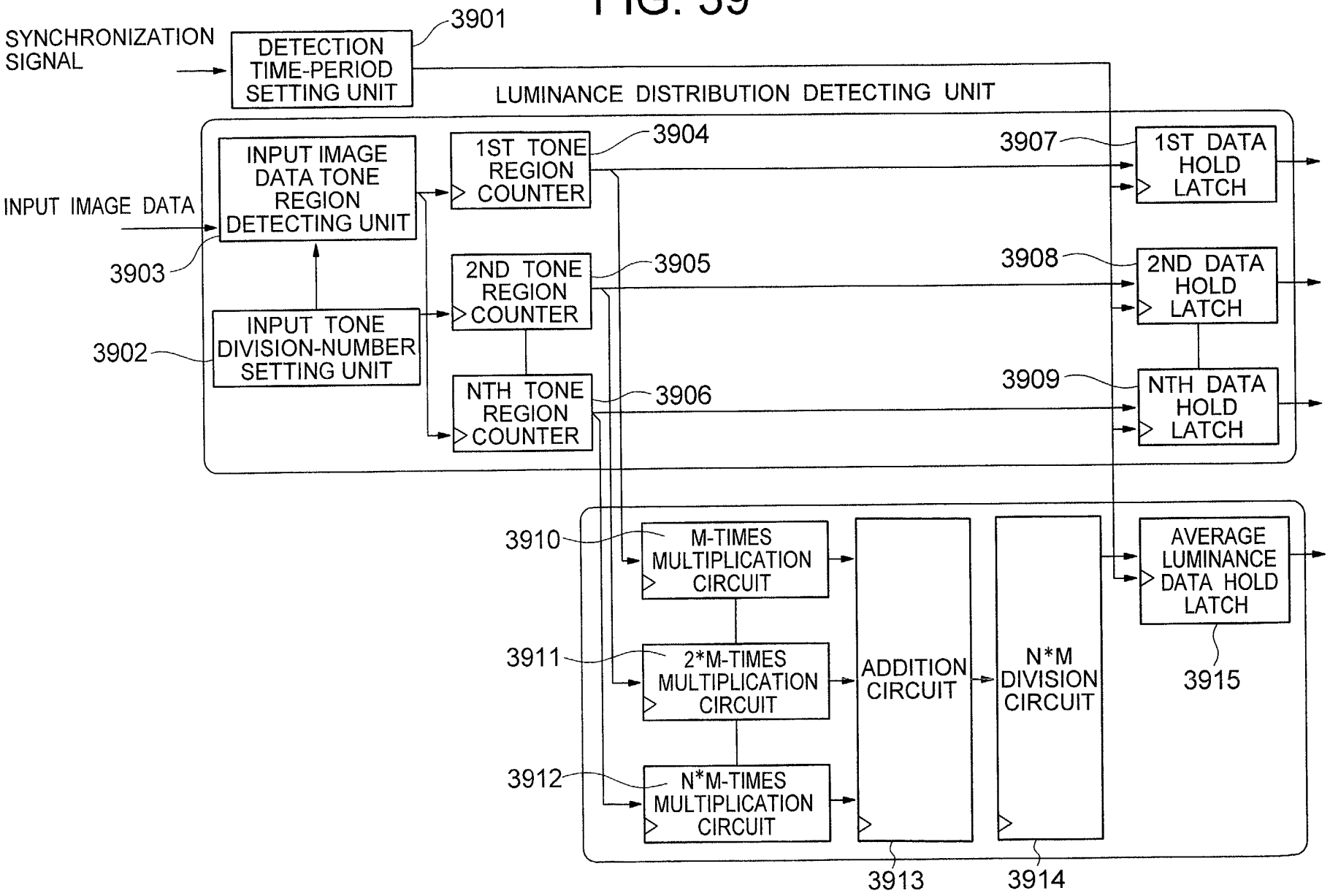

SYNCHRONIZATION SIGNAL
DETECTION TIME-PERIOD SETTING UNIT
3901
LUMINANCE DISTRIBUTION DETECTING UNIT
INPUT IMAGE DATA
INPUT IMAGE DATA TONE REGION DETECTING UNIT
3903
INPUT TONE DIVISION-NUMBER SETTING UNIT
3902
1ST TONE REGION COUNTER
3904
2ND TONE REGION COUNTER
3905
NTH TONE REGION COUNTER
3906
3907
1ST DATA HOLD LATCH
3908
2ND DATA HOLD LATCH
3909
NTH DATA HOLD LATCH
3910
M-TIMES MULTIPLICATION CIRCUIT
3911
2*M-TIMES MULTIPLICATION CIRCUIT
3912
N*M-TIMES MULTIPLICATION CIRCUIT
ADDITION CIRCUIT
3913
N*M DIVISION CIRCUIT
3914
AVERAGE LUMINANCE DATA HOLD LATCH
3915

FIG. 40

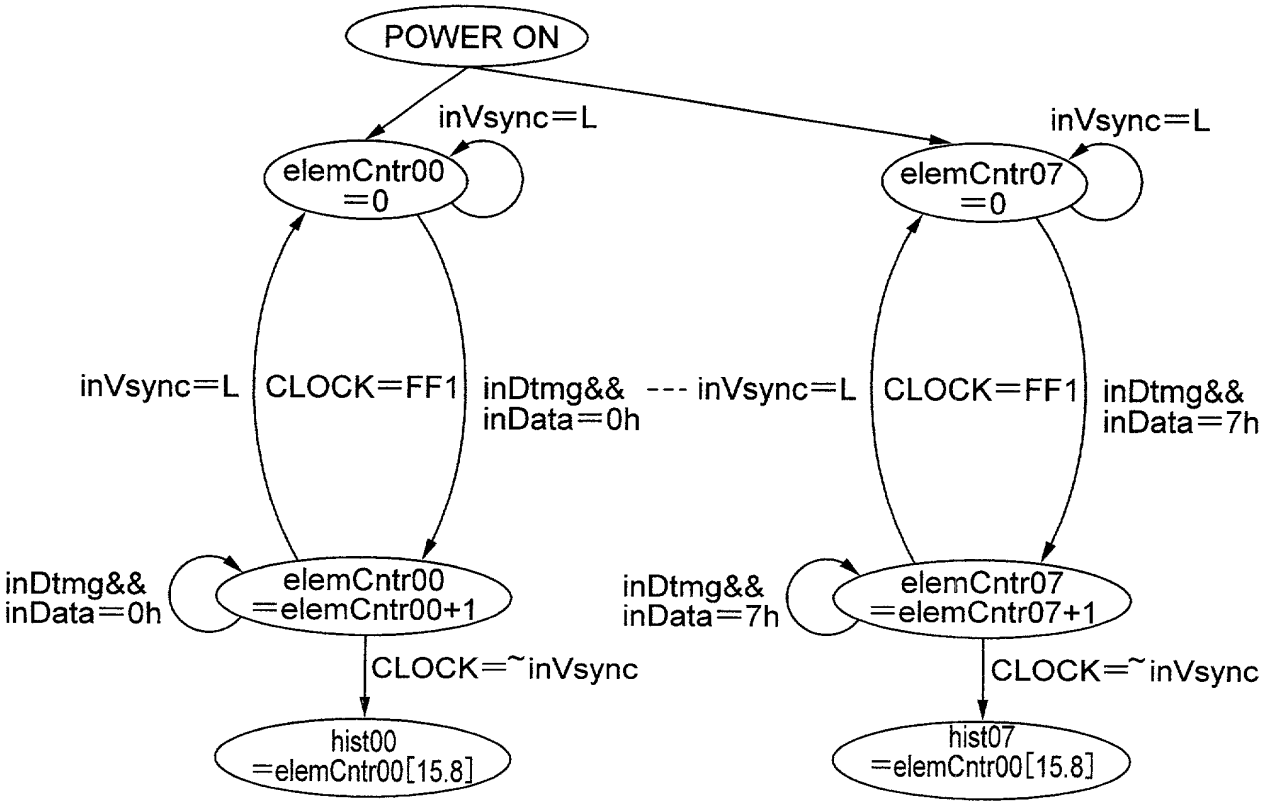

POWER ON
inVsync=L
elemCntr00
=0
inVsync=L
elemCntr07
=0
inVsync=L
CLOCK=FF1
inDtmg&&
inData=0h
inVsync=L
CLOCK=FF1
inDtmg&&
inData=7h
inDtmg&&
inData=0h
elemCntr00
=elemCntr00+1
inDtmg&&
inData=7h
elemCntr07
=elemCntr07+1
CLOCK=~inVsync
CLOCK=~inVsync
hist00
=elemCntr00[15.8]
hist07
=elemCntr00[15.8]

FIG. 41

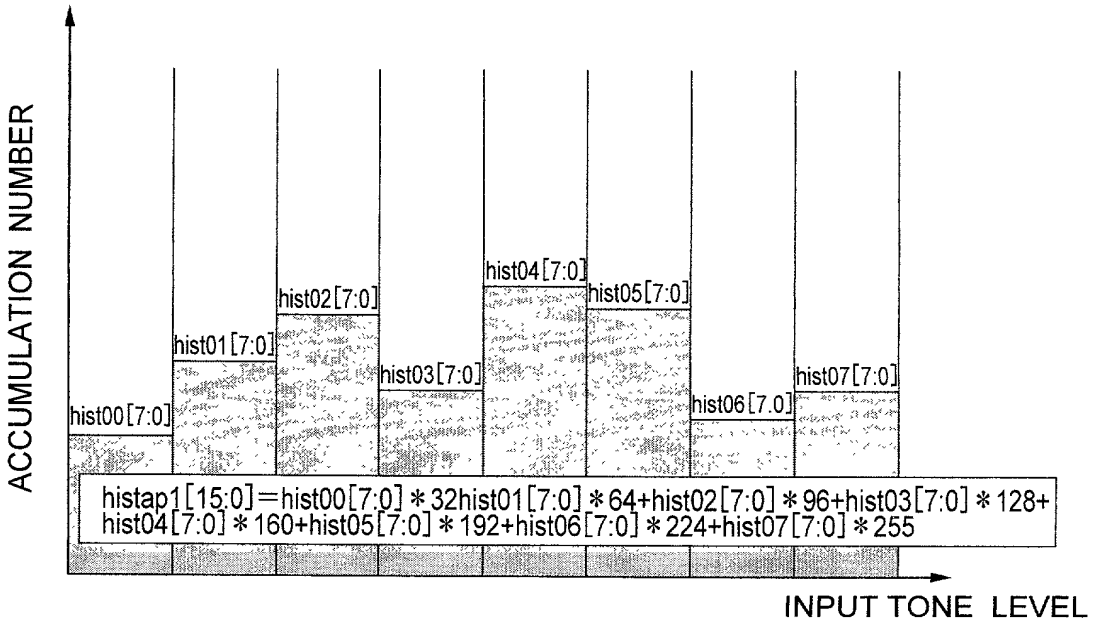

ACCUMULATION NUMBER
hist00[7:0]
hist01[7:0]
hist02[7:0]
hist03[7:0]
hist04[7:0]
hist05[7:0]
hist06[7.0]
hist07[7:0]
histap1[15:0]=hist00[7:0]*32hist01[7:0]*64+hist02[7:0]*96+hist03[7:0]*128+
hist04[7:0]*160+hist05[7:0]*192+hist06[7:0]*224+hist07[7:0]*255
INPUT TONE LEVEL

FIG. 42

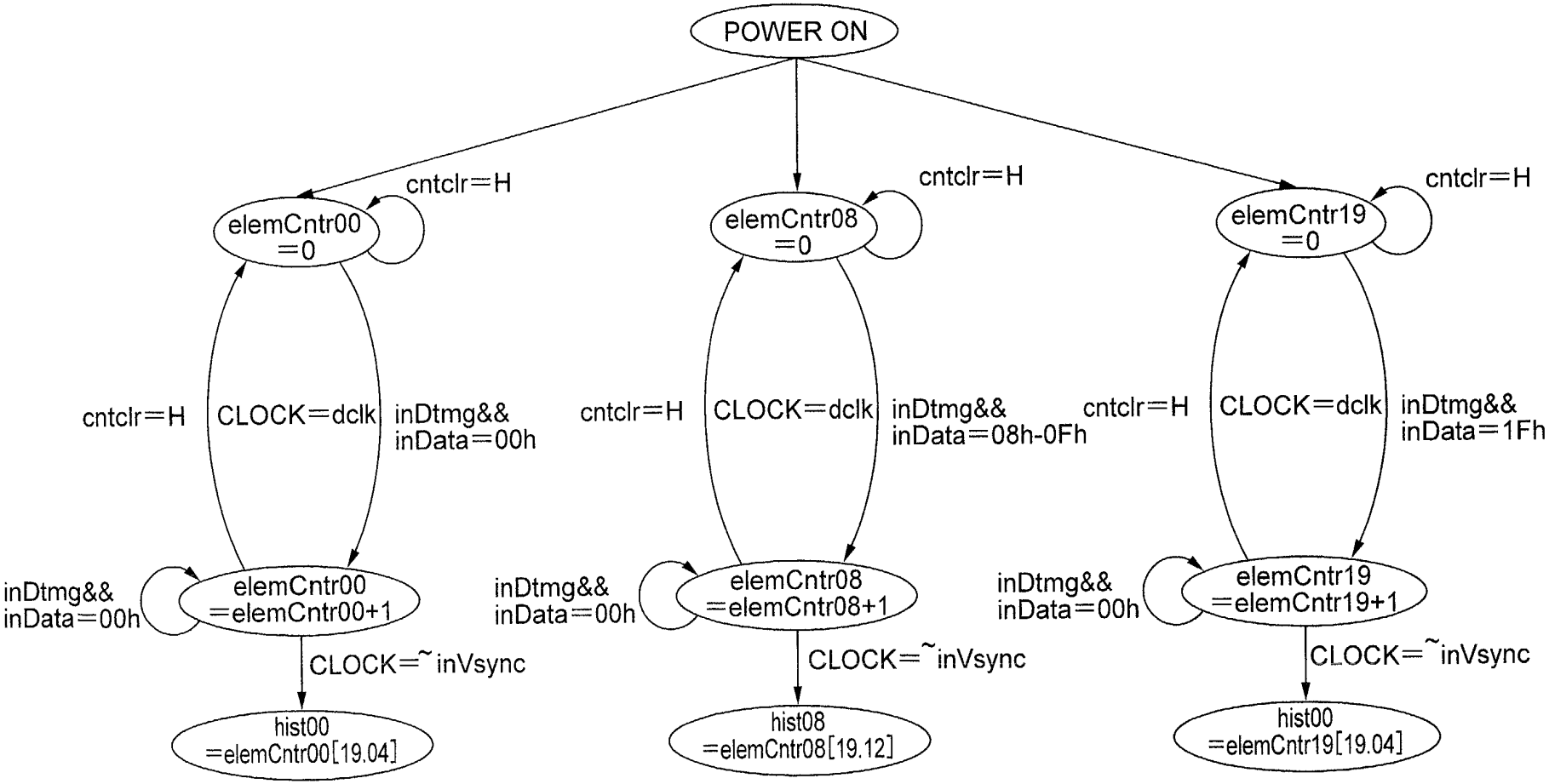

POWER ON
elemCntr00 =0
cntclr=H
cntclr=H
CLOCK=dclk
inDtmg&& inData=00h
elemCntr00 =elemCntr00+1
inDtmg&& inData=00h
CLOCK=~inVsync
hist00 =elemCntr00[19.04]
elemCntr08 =0
cntclr=H
cntclr=H
CLOCK=dclk
inDtmg&& inData=08h-0Fh
elemCntr08 =elemCntr08+1
inDtmg&& inData=00h
CLOCK=~inVsync
hist08 =elemCntr08[19.12]
elemCntr19 =0
cntclr=H
cntclr=H
CLOCK=dclk
inDtmg&& inData=1Fh
elemCntr19 =elemCntr19+1
inDtmg&& inData=00h
CLOCK=~inVsync
hist00 =elemCntr19[19.04]

FIG. 43

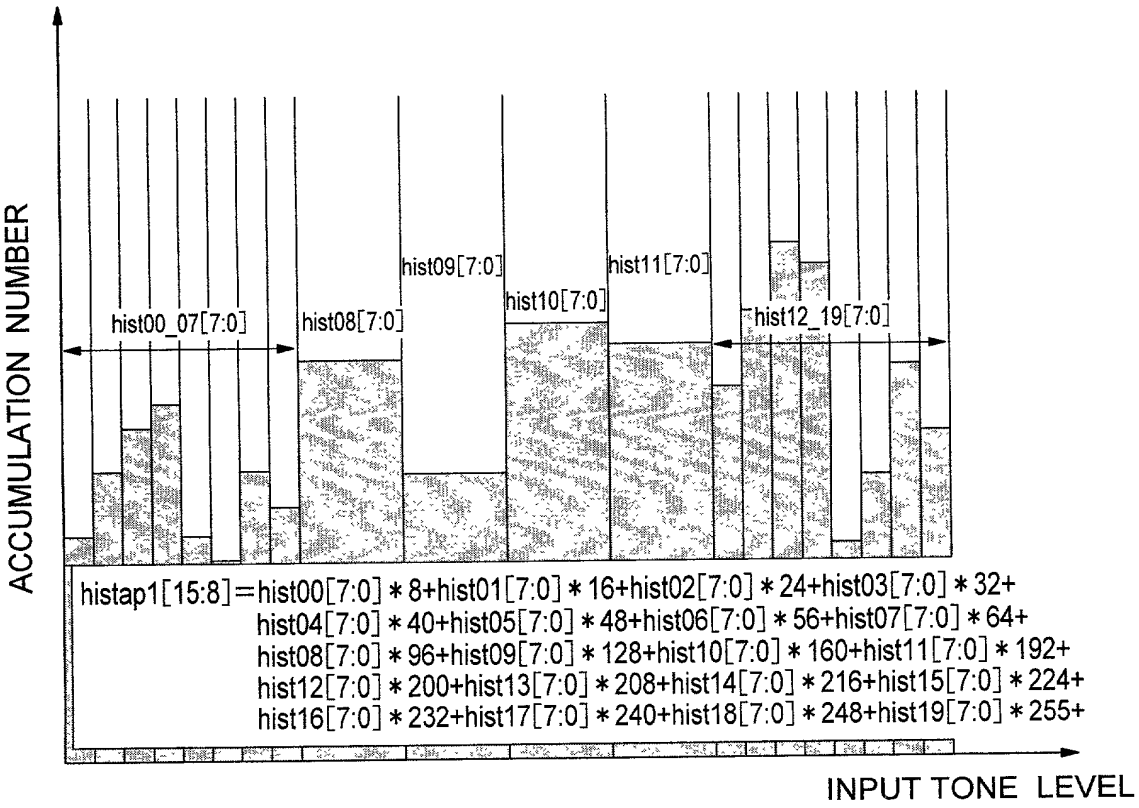

ACCUMULATION NUMBER
hist00_07[7:0]
hist08[7:0]
hist09[7:0]
hist10[7:0]
hist11[7:0]
hist12_19[7:0]
histap1[15:8]=hist00[7:0]*8+hist01[7:0]*16+hist02[7:0]*24+hist03[7:0]*32+
hist04[7:0]*40+hist05[7:0]*48+hist06[7:0]*56+hist07[7:0]*64+
hist08[7:0]*96+hist09[7:0]*128+hist10[7:0]*160+hist11[7:0]*192+
hist12[7:0]*200+hist13[7:0]*208+hist14[7:0]*216+hist15[7:0]*224+
hist16[7:0]*232+hist17[7:0]*240+hist18[7:0]*248+hist19[7:0]*255+
INPUT TONE LEVEL

FIG. 44

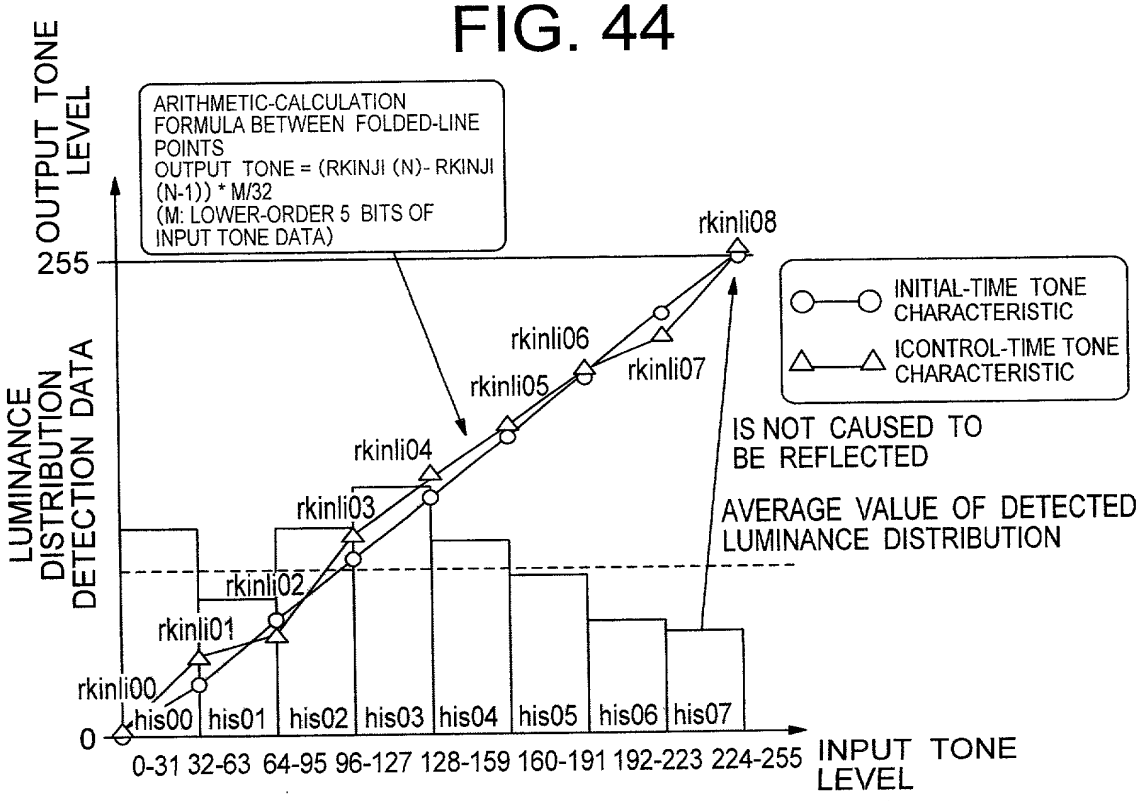

OUTPUT TONE LEVEL
ARITHMETIC-CALCULATION FORMULA BETWEEN FOLDED-LINE POINTS
OUTPUT TONE = (RKINJI (N)- RKINJI (N-1)) * M/32
(M: LOWER-ORDER 5 BITS OF INPUT TONE DATA)
255
rkinli08
rkinli06
rkinli07
rkinli05
rkinli04
rkinli03
rkinli02
rkinli01
rkinli00
INITIAL-TIME TONE CHARACTERISTIC
ICONTROL-TIME TONE CHARACTERISTIC
IS NOT CAUSED TO BE REFLECTED
AVERAGE VALUE OF DETECTED LUMINANCE DISTRIBUTION
LUMINANCE DISTRIBUTION DETECTION DATA
0
his00
his01
his02
his03
his04
his05
his06
his07
0-31 32-63 64-95 96-127 128-159 160-191 192-223 224-255
INPUT TONE LEVEL

FIG.45

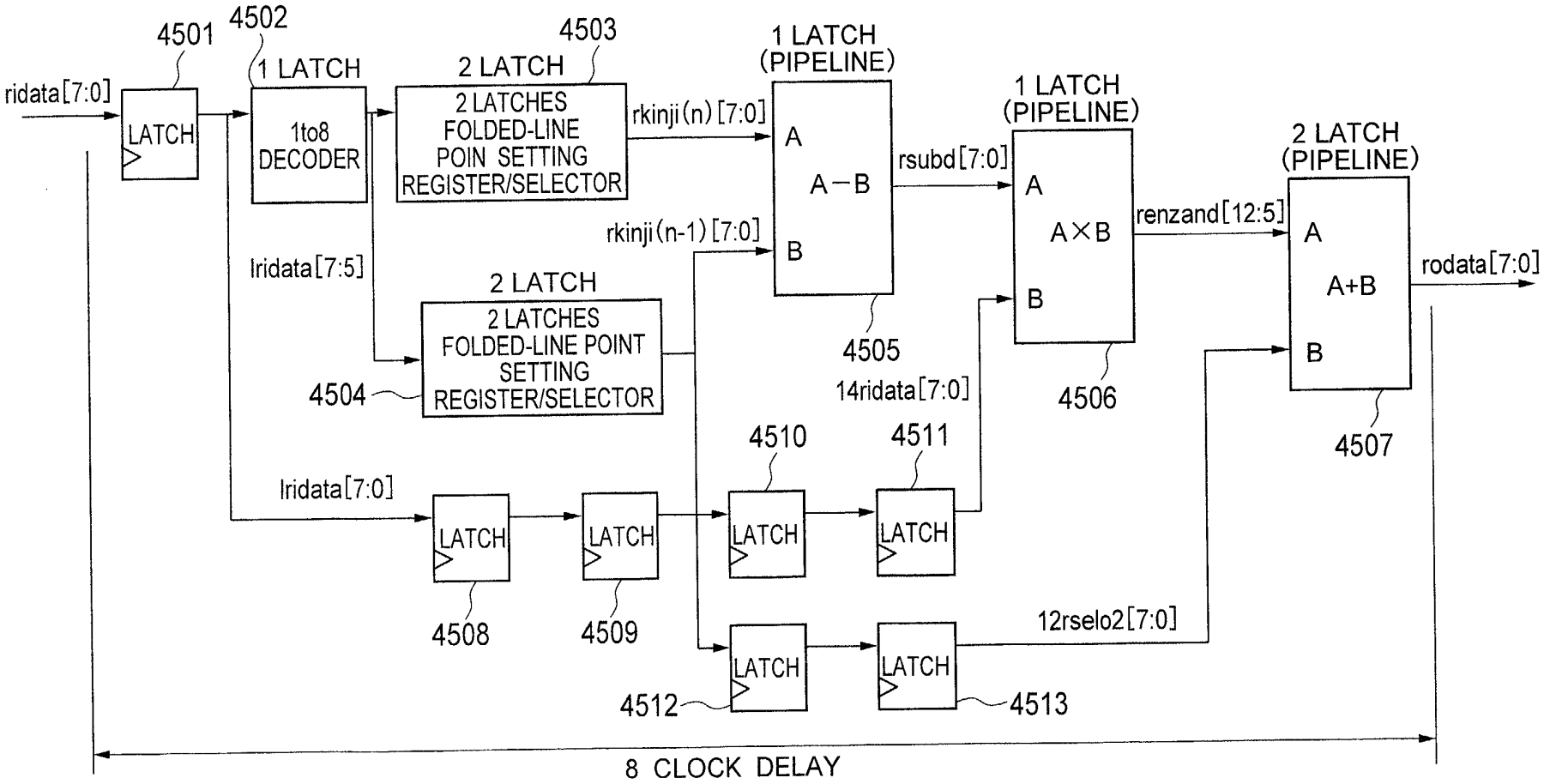

ridata[7:0]
4501
LATCH
4502
1 LATCH
1to8
DECODER
4503
2 LATCH
2 LATCHES
FOLDED-LINE
POIN SETTING
REGISTER/SELECTOR
rkinji(n)[7:0]
1 LATCH
(PIPELINE)
A
A−B
B
4505
rkinji(n-1)[7:0]
rsubd[7:0]
1 LATCH
(PIPELINE)
A
A×B
B
4506
renzand[12:5]
2 LATCH
(PIPELINE)
A
A+B
B
4507
rodata[7:0]
Iridata[7:5]
2 LATCH
2 LATCHES
FOLDED-LINE POINT
SETTING
REGISTER/SELECTOR
4504
14ridata[7:0]
Iridata[7:0]
4510
4511
LATCH
LATCH
LATCH
LATCH
4508
4509
12rselo2[7:0]
LATCH
LATCH
4512
4513
8 CLOCK DELAY

FIG. 46

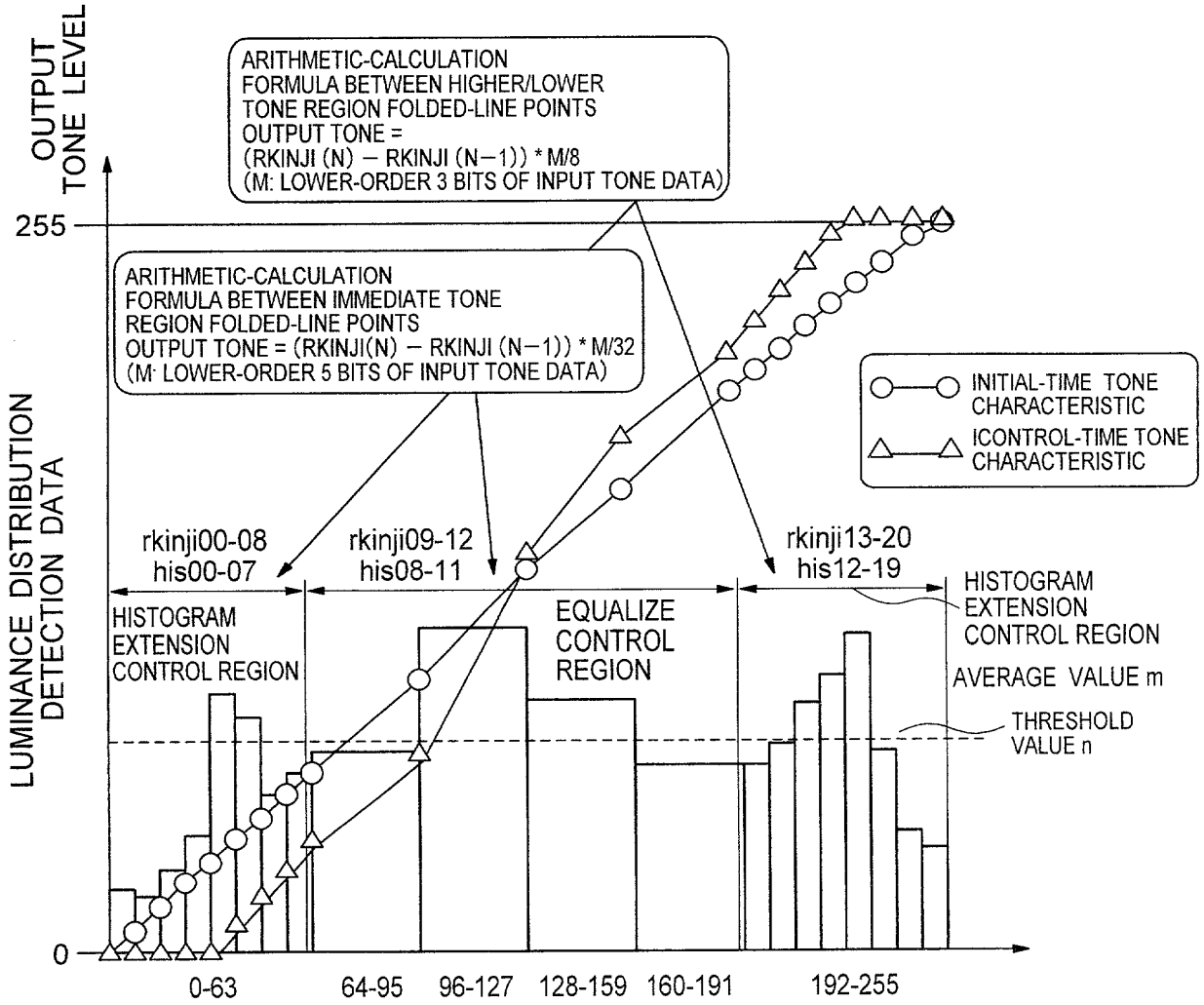

OUTPUT TONE LEVEL
255
0
ARITHMETIC-CALCULATION FORMULA BETWEEN HIGHER/LOWER TONE REGION FOLDED-LINE POINTS
OUTPUT TONE = (RKINJI (N) − RKINJI (N−1)) * M/8
(M: LOWER-ORDER 3 BITS OF INPUT TONE DATA)
ARITHMETIC-CALCULATION FORMULA BETWEEN IMMEDIATE TONE REGION FOLDED-LINE POINTS
OUTPUT TONE = (RKINJI(N) − RKINJI (N−1)) * M/32
(M: LOWER-ORDER 5 BITS OF INPUT TONE DATA)
INITIAL-TIME TONE CHARACTERISTIC
ICONTROL-TIME TONE CHARACTERISTIC
LUMINANCE DISTRIBUTION DETECTION DATA
rkinji00-08
his00-07
rkinji09-12
his08-11
rkinji13-20
his12-19
HISTOGRAM EXTENSION CONTROL REGION
EQUALIZE CONTROL REGION
HISTOGRAM EXTENSION CONTROL REGION
AVERAGE VALUE m
THRESHOLD VALUE n
0-63
64-95
96-127
128-159
160-191
192-255

FIG. 47

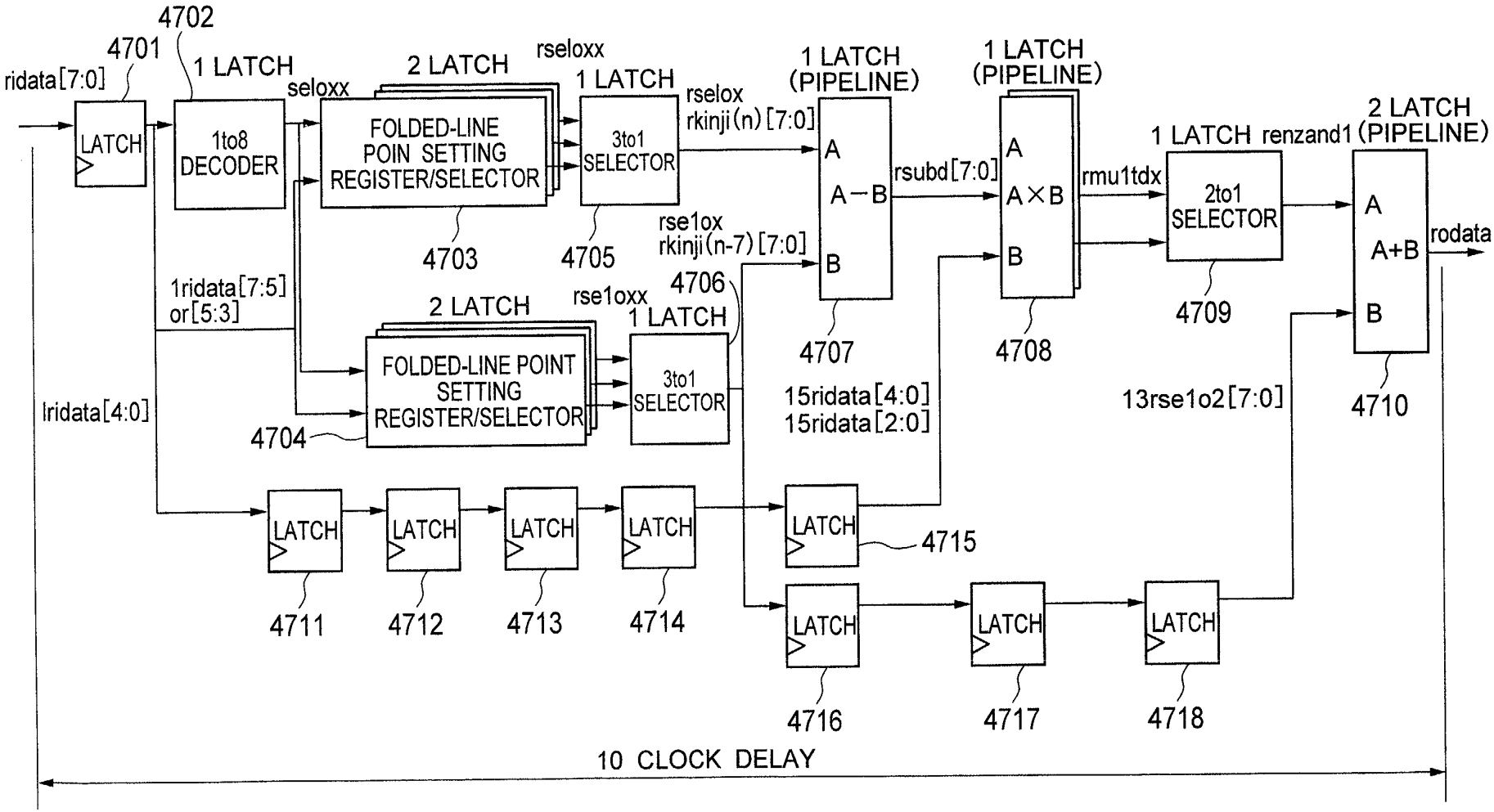

4702
4701
ridata[7:0]
LATCH
1 LATCH
1to8
DECODER
seloxx
2 LATCH
FOLDED-LINE
POIN SETTING
REGISTER/SELECTOR
4703
rseloxx
1 LATCH
3to1
SELECTOR
4705
rselox
rkinji(n)[7:0]
1 LATCH
(PIPELINE)
A
A−B
B
4707
rsubd[7:0]
1 LATCH
(PIPELINE)
A
A×B
B
4708
rmu1tdx
1 LATCH
2to1
SELECTOR
4709
renzand1
2 LATCH
(PIPELINE)
A
A+B
B
4710
rodata
rse1ox
rkinji(n-7)[7:0]
4706
1ridata[7:5]
or[5:3]
2 LATCH
FOLDED-LINE POINT
SETTING
REGISTER/SELECTOR
4704
rse1oxx
1 LATCH
3to1
SELECTOR
15ridata[4:0]
15ridata[2:0]
13rse1o2[7:0]
lridata[4:0]
LATCH
LATCH
LATCH
LATCH
4711
4712
4713
4714
LATCH
4715
LATCH
LATCH
LATCH
4716
4717
4718
10 CLOCK DELAY

FIG. 48

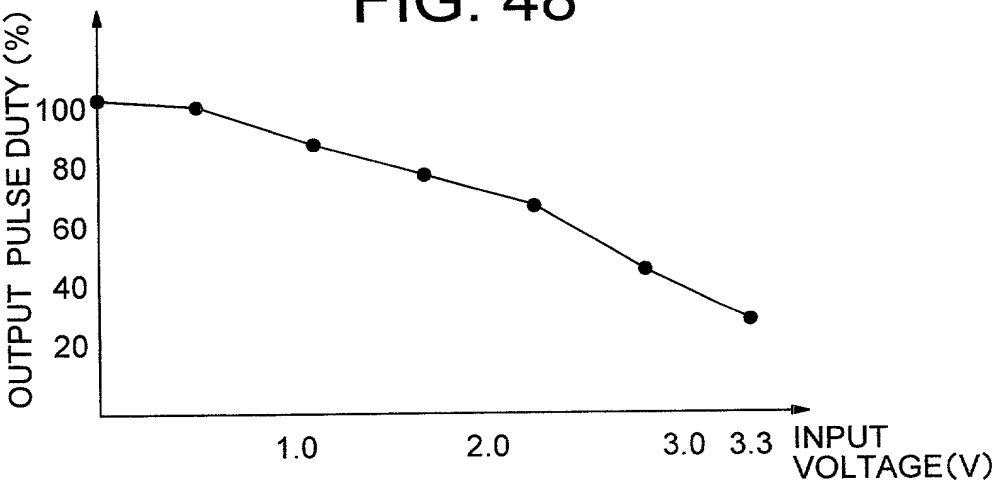

OUTPUT PULSE DUTY (%)
100
80
60
40
20
1.0
2.0
3.0
3.3
INPUT VOLTAGE(V)

FIG. 49

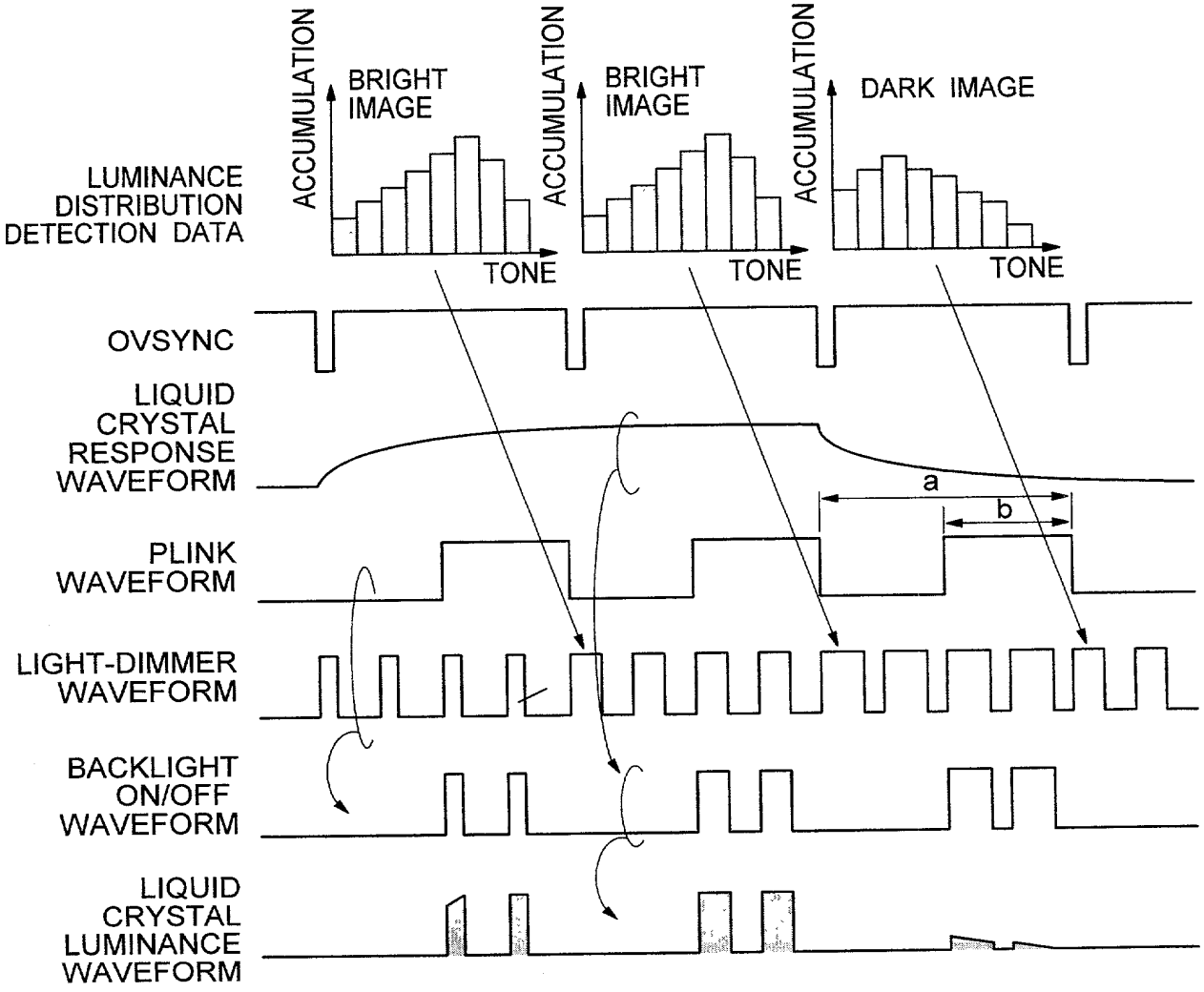

LUMINANCE DISTRIBUTION DETECTION DATA
ACCUMULATION
BRIGHT IMAGE
TONE
ACCUMULATION
BRIGHT IMAGE
TONE
ACCUMULATION
DARK IMAGE
TONE
OVSYNC
LIQUID CRYSTAL RESPONSE WAVEFORM
a
b
PLINK WAVEFORM
LIGHT-DIMMER WAVEFORM
BACKLIGHT ON/OFF WAVEFORM
LIQUID CRYSTAL LUMINANCE WAVEFORM

FIG. 50

a+b+c+d+e+f+g+h=192POINTS
IMAGE JUDGING CONDITION
JUDGING CONDITION 1: BRIGHT IMAGE (LARGE NUMBER OF HIGHER-ORDER TONE DISTRIBUTION REGIONS)
E > 48 POINTS OR F > 40 POINTS OR G > 32 POINTS OR H > 24 POINTS
JUDGING CONDITION 2: DARK IMAGE (LARGE NUMBER OF LOWER-ORDER TONE DISTRIBUTION REGIONS)
OTHER THAN THE ABOVE-MENTIONED JUDGING CONDITION 1
(LARGE NUMBER OF HIGHER-ORDER TONE DISTRIBUTION REGIONS)

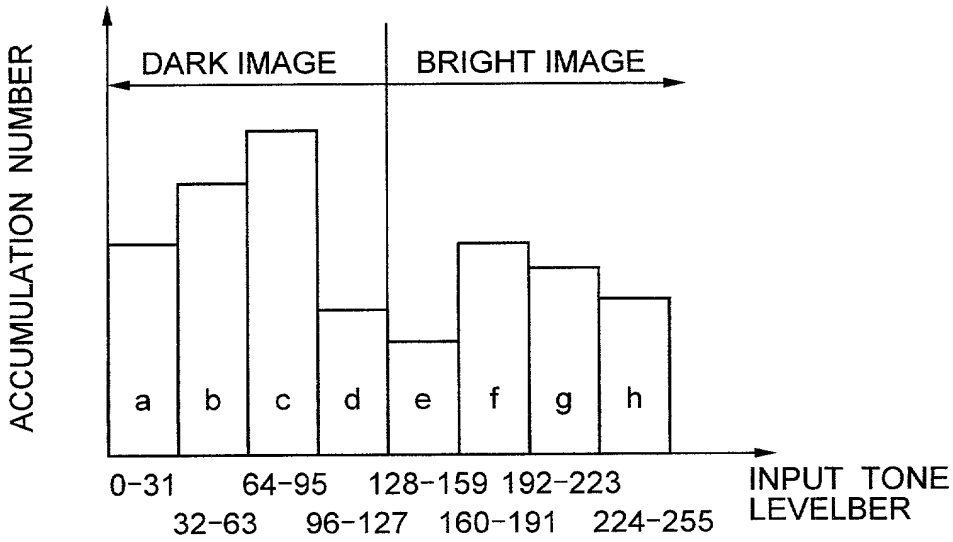


FIG. 51

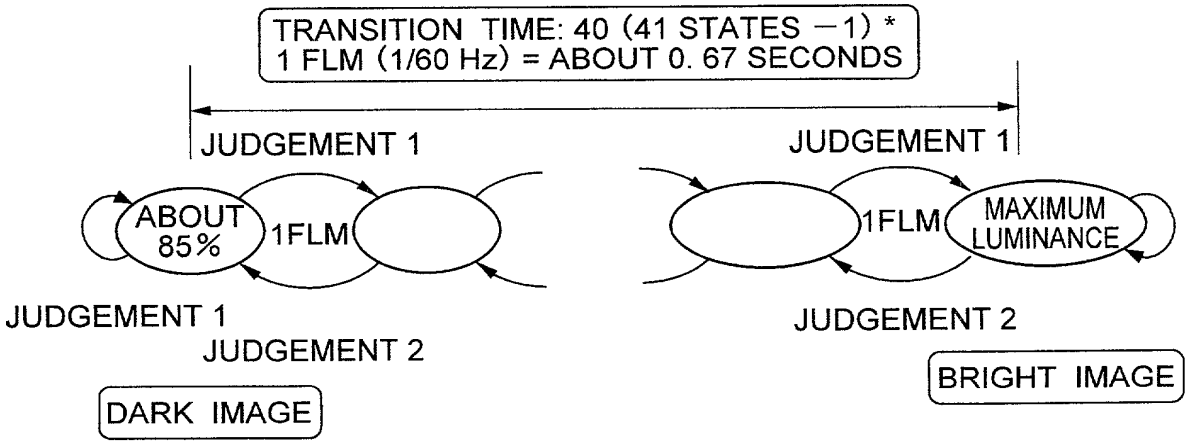


FIG. 52

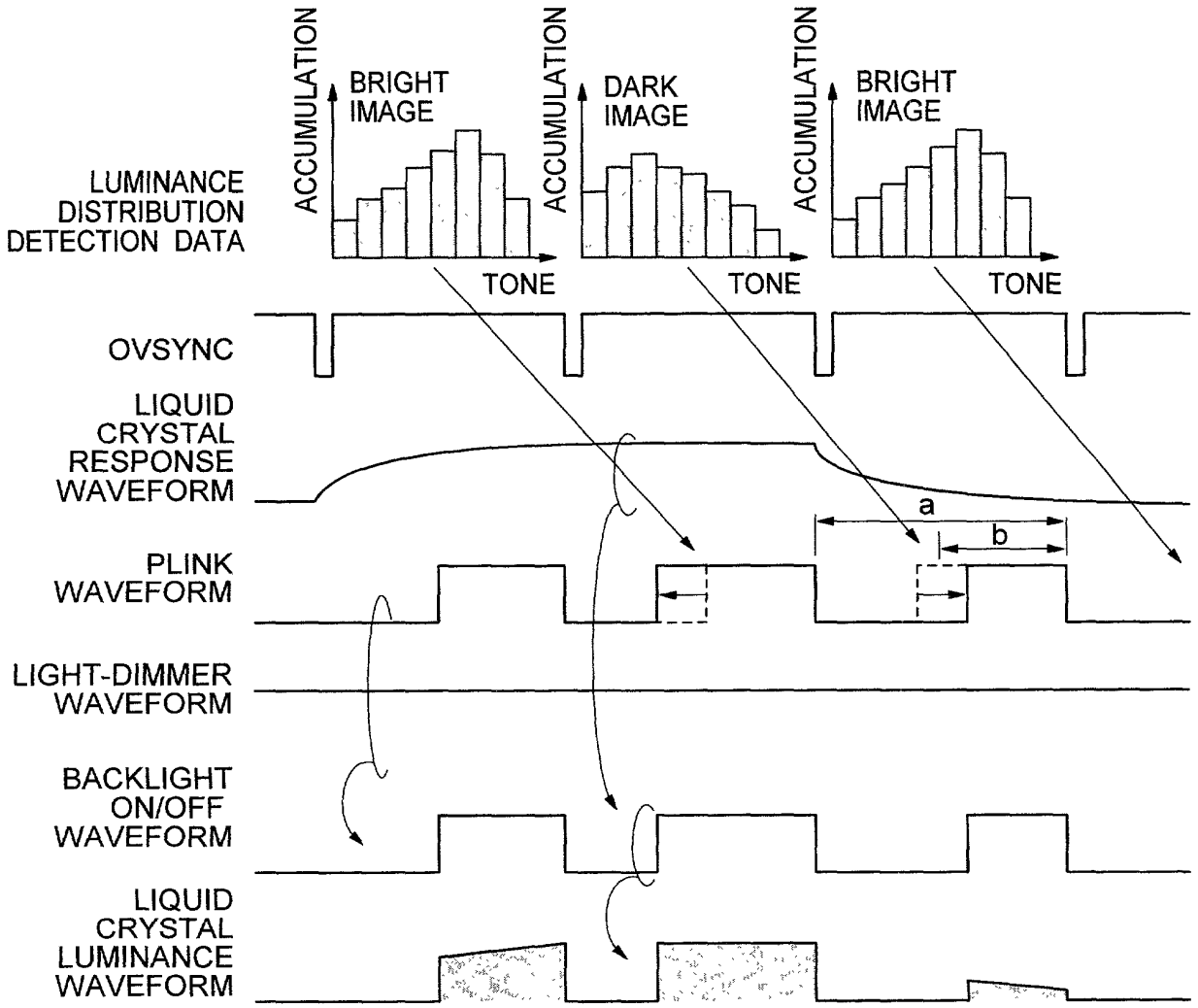

ACCUMULATION
BRIGHT IMAGE
ACCUMULATION
DARK IMAGE
ACCUMULATION
BRIGHT IMAGE
LUMINANCE DISTRIBUTION DETECTION DATA
TONE
TONE
TONE
OVSYNC
LIQUID CRYSTAL RESPONSE WAVEFORM
a
b
PLINK WAVEFORM
LIGHT-DIMMER WAVEFORM
BACKLIGHT ON/OFF WAVEFORM
LIQUID CRYSTAL LUMINANCE WAVEFORM

FIG. 53

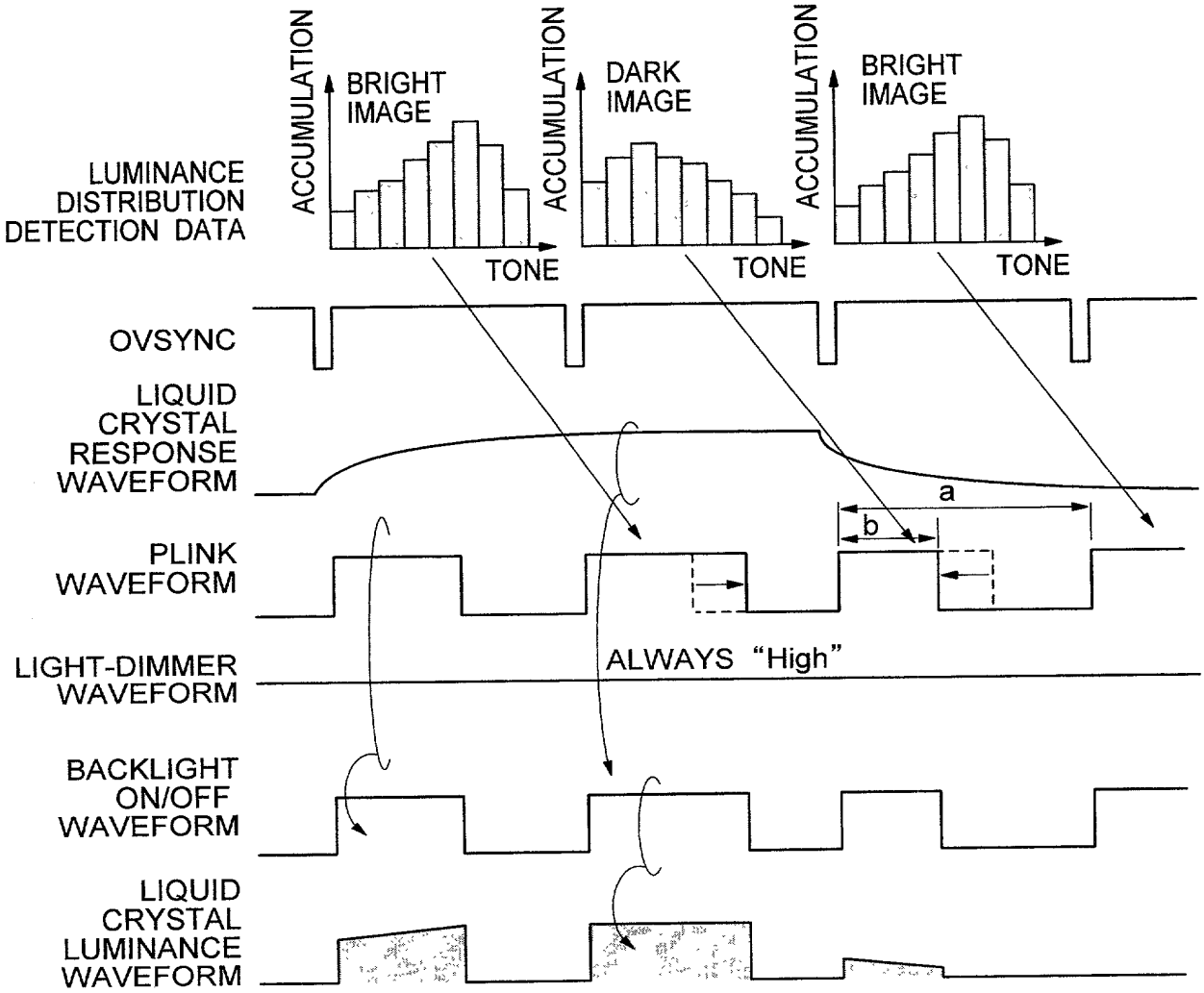

LUMINANCE DISTRIBUTION DETECTION DATA
ACCUMULATION
BRIGHT IMAGE
TONE
ACCUMULATION
DARK IMAGE
TONE
ACCUMULATION
BRIGHT IMAGE
TONE
OVSYNC
LIQUID CRYSTAL RESPONSE WAVEFORM
a
b
PLINK WAVEFORM
LIGHT-DIMMER WAVEFORM
ALWAYS "High"
BACKLIGHT ON/OFF WAVEFORM
LIQUID CRYSTAL LUMINANCE WAVEFORM

FIG. 54

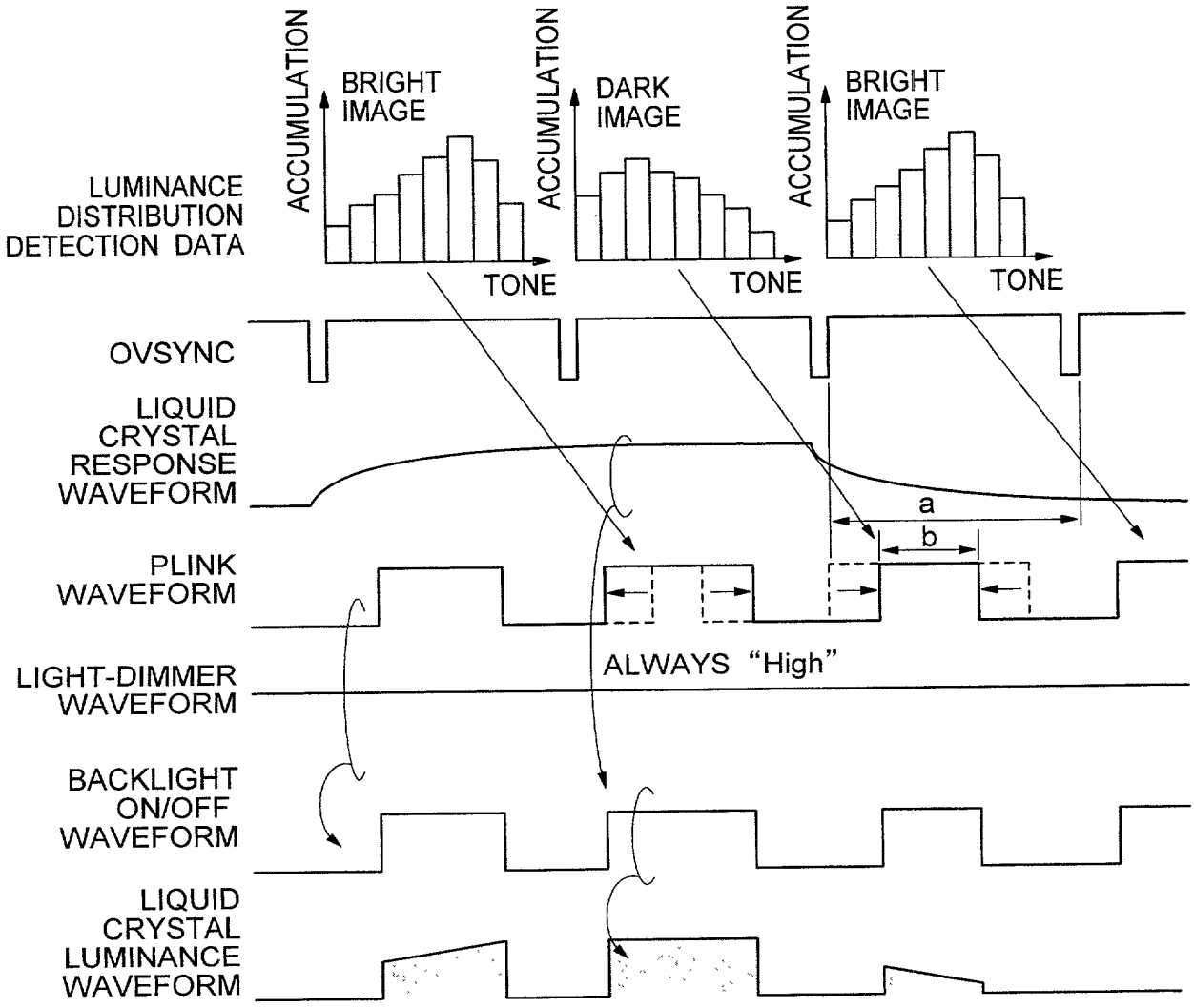
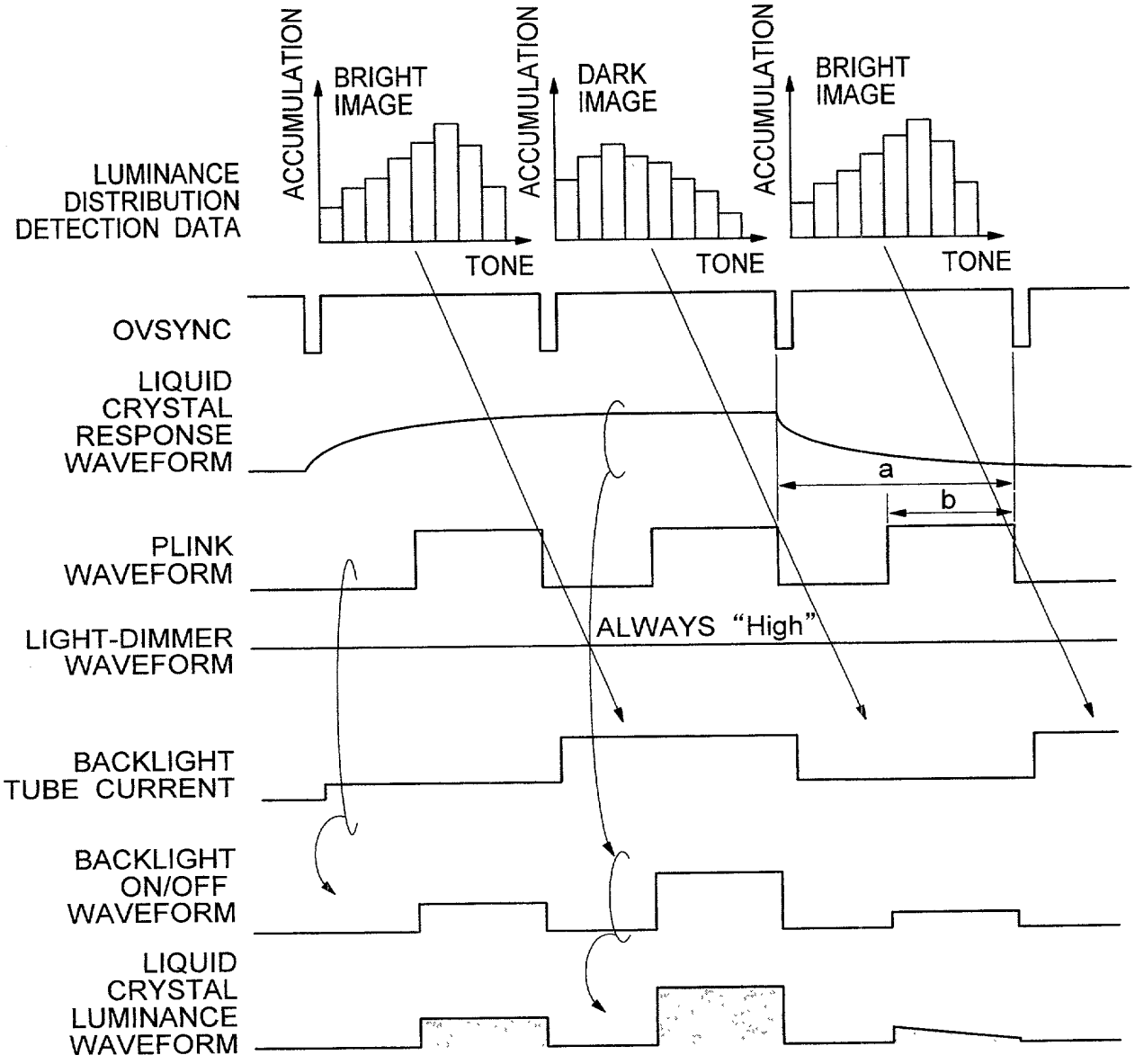

LUMINANCE DISTRIBUTION DETECTION DATA
ACCUMULATION
BRIGHT IMAGE
TONE
ACCUMULATION
DARK IMAGE
TONE
ACCUMULATION
BRIGHT IMAGE
TONE
OVSYNC
LIQUID CRYSTAL RESPONSE WAVEFORM
a
b
PLINK WAVEFORM
ALWAYS "High"
LIGHT-DIMMER WAVEFORM
BACKLIGHT ON/OFF WAVEFORM
LIQUID CRYSTAL LUMINANCE WAVEFORM

FIG. 55


LUMINANCE DISTRIBUTION DETECTION DATA
ACCUMULATION
BRIGHT IMAGE
TONE
ACCUMULATION
DARK IMAGE
TONE
ACCUMULATION
BRIGHT IMAGE
TONE
OVSYNC
LIQUID CRYSTAL RESPONSE WAVEFORM
a
b
PLINK WAVEFORM
LIGHT-DIMMER WAVEFORM
ALWAYS "High"
BACKLIGHT TUBE CURRENT
BACKLIGHT ON/OFF WAVEFORM
LIQUID CRYSTAL LUMINANCE WAVEFORM